VEHICLE SLIP CONTROL DEVICE

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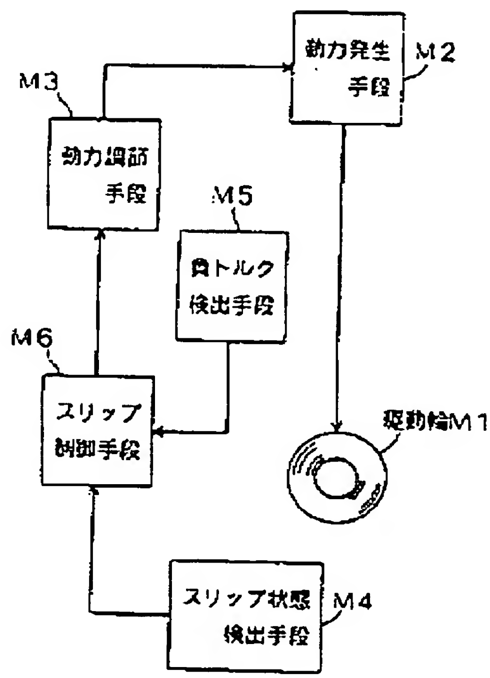
Abstract of **JP2191833**

PURPOSE:To suppress an excessive slip by adjusting a power adjusting means controlling a drive wheel for its detected slip condition to a predetermined condition when the drive wheel is detected for its negative torque generated. CONSTITUTION:Power from a power generating means M2 is transmitted to a drive wheel M1 running a vehicle. Reversely when the power is decreased, negative torque is generated in the drive wheel M1 by various losses in the power generating means M2, here it generates an engine brake providing possibility of generating an excessive slip on a low friction road. Accordingly, when the negative torque is detected in a detecting means M5, a slip control means M6 adjusts a power adjusting means M3 controlling power generated by the power generating means M2 and a slip condition of the drive wheel M1 to a predetermined condition. Thus stabilization can be contrived of the running vehicle by suppressing the excessive slip caused by the engine brake.



CLAIMS

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(57) [Claim(s)]
[Claim 1] The accelerator pedal which breaks in by crew and is adjusted, and a signal transformation means to change into an electric signal said treading-in actuation condition of crew which carries out an accelerator pedal pair, A dynamogenesis means to generate the power for being carried in a car and making it run this car through a driving wheel, A power accommodation means to adjust the power yield of said dynamogenesis means according to said electric signal changed by said signal transformation means, A revolution condition detection means to detect the revolution condition of said car, and a negative torque detection means to detect having given the negative torque said whose dynamogenesis means is the moderation direction of said car to said driving wheel, When said negative torque is detected by said negative torque detection means, the more the degree of the revolution condition of said car which it is as a result of [of said revolution condition detection means] detection is large, the more The adjustable control means which performs said power accommodation means and carries out adjustable [of the amount of accommodation of said power yield] so that the negative torque which is the moderation direction of said car about the amount of accommodation of said power yield may be controlled in the direction made small, The car slip control unit characterized by having a limit means to restrict so that the power given to said driving wheel may not serve as forward torque substantially, when the amount of accommodation adjustable control of said power yield is made in said adjustable control means.
[Claim 2] In a car slip control unit according to claim 1 further said adjustable control means While controlling the slip condition of the driving wheel detected with said slip condition detection means in the case of activation of said power accommodation means to be in a predetermined criteria slip condition The car slip control unit characterized by setting up said criteria slip condition small so that the degree of the revolution condition of said car is large and the negative torque which is the moderation direction of said car may become small.
[Claim 3] A dynamogenesis means to generate the power for being carried in a car and making it run this car through a driving wheel, A power accommodation means to adjust the power yield of said dynamogenesis means, and a slip condition detection means to detect the slip condition of the driving wheel at the time of acceleration of said car, The traction control means which controls the acceleration slip condition of a driving wheel according to the detection result of said slip condition detection means, A revolution condition detection means to detect the revolution condition of said car, and a negative torque detection means to detect having given the negative torque said whose dynamogenesis means is the moderation direction of said car to said driving wheel, When said negative torque is detected by said negative torque detection means at the time of activation of said traction control means, The car slip control unit characterized by having the adjustable control means which performs said power accommodation means according to the degree of the revolution condition of said car which it is as a result of [of said revolution condition detection means] detection, and carries out adjustable [of the amount of accommodation of said power yield].

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
The purpose of invention [Industrial Application]
When the engine brake works at the time of revolution, this invention tends to prevent the fall of a side force and tends to attain good car transit stability.
[Description of the Prior Art]
In order to prevent the slip of the driving wheel produced at the time of rapid start of an automobile, the equipment which controls opening of a throttle valve so that slip ratio S which becomes settled from Vd the travel speed Vb of the car called for from a coupled driving wheel and whenever [speed-of-drive-wheel], is settled in the predetermined range (traction control) is known (JP,62-121839,A).
Moreover, in order to prevent that a driving wheel races, a side force falls and a car carries out spin as same technique at the time of revolution of a car, the equipment which controls an engine output so that the longitudinal direction acceleration of a car does not exceed predetermined threshold value is also known (JP,62-10437,A).
In order that both these techniques may prevent that a driving wheel slips according to the excess of engine power, they reduce the opening of a throttle valve with an electric actuator, and are carrying out reduction control of engine power.
[Problem(s) to be Solved by the Invention]
The cure is conversely proposed as this also about un-arranging [of engine power / which is depended too little]. That is, when a driving wheel slips on low friction ways, such as a freezing way, by generating of torque (torque of the moderation direction of the car given to a driving wheel from an engine) negative in an engine, and the so-called engine brake, engine power is raised conversely, a slip of a driving wheel is reduced, and the stability of car transit is secured.
However, in order to prevent that a driving wheel slips by engine brake in this way, even if it performed control which raises engine power, when the car was circling, car stability may fall and it turned out that it is inadequate as a cure.
[Objects of the Invention]
The purpose of this invention tends to prevent the fall of the car stability produced by the engine brake in the time of revolution.
Configuration of invention [The means for solving a technical problem]
the car slip control unit of this invention is shown in the fundamental block diagram of Fig. 1 -- as -- With the accelerator pedal which breaks in by crew and is adjusted A signal transformation means to change into an electric signal the treading-in actuation condition of said crew who does an accelerator pedal pair, A dynamogenesis means M2 to generate the power for being carried in car and making it run this car through a driving wheel M1, A power accommodation means M3 to adjust the power yield of said dynamogenesis means according to said electric signal changed by said signal transformation means, A revolution condition detection means M4 to detect the revolution condition of said car A negative torque detection means M5 to detect having given the negative torque said whose dynamogenesis means is the moderation direction of said car to said driving wheel, When said negative torque is detected by said negative torque detection means, The more the degree of the revolution condition of said car which it is as a result of [of said revolution condition detection means] detection is large, the more The adjustable control means M6 which performs said power accommodation means and carries out adjustable [of the amount of accommodation of said power yield] so that the negative torque which is the moderation direction of said car about the amount of accommodation of said power yield may be controlled in the direction made small, A limit means M7 to restrict so that the power given to said driving wheel may not serve as forward torque substantially, when

the amount of accommodation adjustable control of said power yield is made in said adjustable control means It is characterized by having.

[Function and Effect(s) of the Invention]

A signal transformation means changes actuation of this accelerator pedal into an electric signal with actuation of the accelerator pedal operated by crew. And it is the so-called engine control equipment of the link loess throttle type which adjusts the power with which a power accommodation means is generated in a dynamogenesis means in connection with this electric signal. And in such equipment, if the car is circling when the operation ******** engine brake operation which power declines and slows down a car arises, the side force of a tire will fall. Although the fall of this side force changes according to the degree of a car revolution condition, when negative torque is detected by the negative torque detection means, it adjusts a power yield according to the magnitude of a revolution condition by the adjustable control means. Under the present circumstances, since between an accelerator pedal and throttle valves with a concrete power accommodation means is only connected by the electric signal by the link loess throttle and a mechanical link mechanism does not exist, it is substantially possible not to make an accelerator pedal produce sense of incongruity, and to adjust from full open of a throttle valve to a close by-pass bulb completely with a power accommodation means in connection with an adjustable control means. Therefore, the controllability in the engine output control which took the example in negative torque and a revolution condition is very high. Moreover, if it is made for the power substantially given to a driving wheel not to serve as forward torque with a limit means, by a certain cause, reduction which a car changes to a reverse condition from moderation to acceleration can be prevented, and the run state stabilized further can be secured. In addition, if the throttle valve is substantially controllable from a close by-pass bulb completely to full open, in case it adjusts so that it may not become forward torque with a limit means, there is a merit that a controllability increases.

Moreover, if it is made to perform during traction control in case an adjustable control means performs the engine output control which took the example in negative torque and a revolution condition, control of the engine power which took the example in the both sides of the slip condition by the negative torque accompanying acceleration slip control and the slip condition accompanying revolution is realizable. Under the present circumstances, it is usually at the car start time that traction control is performed in many cases, and the acceleration slip at the time of this car start becomes very large in many cases. It will be in the condition that this will have [treading in of the accelerator pedal in the case of the start from the stop condition of a car] the most stable car if it is common not to be comparatively exact compared with the time of transit, for example, the present condition is in a stop condition, and if compared whenever [over pedal treading in in this condition / cautions], and during a stop, whenever [over the accelerator actuation under transit with low sense of stability / cautions] will be because it differs. Therefore, the negative torque under this traction control can consider the case of being very large, and can secure the stability of a car most effectively by performing both ****** engine output control for negative torque and a revolution condition during traction control.

Fig. 2 is an outline block diagram showing one example of this invention car slip control unit. In addition, expressing it as negative torque or negative torque expresses hereafter the torque of the direction which slows down the car given to a driving wheel (the right rear ring 31, left rear ring 33) from an internal combustion engine 1 as mentioned above.

An internal combustion engine (only henceforth an engine) 1 is the 4-cylinder gasoline engine of a jump-spark-ignition type, and is carried in the car. The inlet pipe 3 and the exhaust pipe 5 are connected to the engine 1. An inlet pipe 3 consists of surge tank 3b connected with set section 3a connected to the air cleaner which is not illustrated, and this set section 3a, and tee 3c which branched from surge tank 3b corresponding to each gas column of an engine 1.

The throttle valve 7 for adjusting the output which adjusts the air content inhaled by the engine 1 to set section 3a, and is generated with an engine 1 is formed. The valve stem of this throttle valve 7 is connected with the step motor 9 which adjusts the opening of this throttle valve 7, and the throttle sensor 11 which detects the opening of a throttle valve 7.

In addition, motor close-by-pass-bulb-completely sensor 9a which detects the closed position of a motor 9 is prepared in the step motor 9.

Moreover, the intake temperature sensor 13 which detects an intake-air temperature is formed in the upper location of the throttle valve 7 of set section 3a.

The pressure-of-induction-pipe force sensor 14 which detects the pressure in an inlet pipe 3 is formed in surge tank 3b, and the electromagnetic fuel injection valve 15 which injects a fuel is respectively formed in

tee 3c at each tee 3c.
Moreover, the ignition plug 17 for lighting the gaseous mixture inhaled corresponding to each gas column is formed in the engine 1. This ignition plug 17 is connected with the distributor 19 through the high tension code, and this distributor 19 is electrically connected with the ignitor 21. And rotation sensor 19a which outputs the signal which synchronized with engine rotation is prepared for the above-mentioned distributor 19.
Furthermore, the coolant temperature sensor 23 which detects the temperature of the cooling water which cools an engine 1 is formed in the engine 1.
The power generated with the engine 1 is told to a torque converter 25, a change gear 27, the right rear ring 31 that makes a driving wheel through differential gear 29 grade, and the left rear ring 33. And Sensors 31a, 33a, 35a, and 37a are formed in the forward right ring 35 and the forward left ring 37 which the above-mentioned change gear 27 is equipped with gear location sensor 27a which outputs the gear position signal corresponding to the gear location, and the right rear ring 31, the left rear ring 33, and a coupled driving wheel make whenever [for detecting wheel rotational speed, respectively / wheel speed].
Rudder angle sensor 39a detects the rudder angle SA of front wheels 35 and 37 which changes by actuation of a steering 39. The rudder angle SA is shown by the tangent Ld on the midpoint FC of the circle which passes along the midpoint FC of the forward right ring 35 and the forward left ring 37 focusing on the center line of rotation CC of a car, and the include angle with the direction Md of a car to make as shown in Fig. 20.
Accelerator control input sensor 41a which outputs the signal corresponding to each above-mentioned sensor and the control input of an accelerator pedal 41, and an accelerator pedal 41 are released. The signal of brake sensor 43a turned on when it gets into accelerator close-by-pass-bulb-completely sensor 41b which detects the condition of being an accelerator close by-pass bulb completely, and a brake pedal 43 is inputted into an electronic control unit (ECU) 50. ECU50 outputs the signal for driving the above-mentioned step motor 9, an injection valve 15, and an ignitor 21 based on these signals.
RAM50b in which data [in the operation in CPU50a and CPU50a which perform various kinds of operations] to be described [ECU / 50] above are stored temporarily, ROM50d in which RAM50c in which the data which need storage maintenance are stored even if it is after it is similarly required of the operation in CPU50a, being serially updated among engine performance and turning off the key switch 51 of a car, the constant used by the operation in CPU30a are stored beforehand, The input port 50e list for inputting the signal of each above-mentioned sensor is received at CPU50a according to the contents of data (input counter 50f, timer 50g which measures time amount, input counter 50f, and timer 50g). Bus-line 50l., the dc-battery 53, and key switch 51 which make the output circuits 50i, 50j, and 50k which output the signal for driving 50h of interrupt control sections to which an interrupt is applied, a step motor 9, an injection valve 15, and an ignitor 21, and the data transfer way between each above-mentioned ECU component are minded. It connected, direct continuation was carried out to 50m of power circuits which supply power to each of other element except RAM50c, and a dc-battery 53, and it has 50n of power circuits which supply power to RAM50c. A flow chart explains the drag control processing performed by the above ECU 50 below.
Fig. 3 is the outline flowchart of the program, and steps 2000 and 3000 are first performed as initialization processing. That is, it starts by reset to a power up, and each control variable is initialized at step 2000. Furthermore, the check of operation known for step 3000 as initialization and the primary check of the active position of an actuator is performed.
At the following step 4000, digital one of various kinds of and the input of an analog signal, the judgment of a car run state, and the creation of data and a setup of a flag corresponding to the judgment are performed as signal input base processing. Then, at step 5000, fuel oil consumption for fuel-injection executive operation is computed as fuel-injection base processing, and target throttle opening is computed as throttle control base processing at step 6000. It moves to the condition of regular interrupt pending after step 6000 termination. Regular interruption interrupts timer 50g of Fig. 2 at step 2000, and sets up spacing time amount (for example, 10ms), it generates every 10ms after that, and 4000 or less step is started.
Next, a 4th [**] Fig. R> Fig. explains the detail of signal input base processing of step 4000. In this processing, the intake-air temperature THA, the accelerator control input AA, the pressure-of-induction-pipe force PM, the cooling water temperature THW, the throttle opening TA, the rudder angle SA, and the gear location GP of an analog signal are first inputted at step 4100, and the accelerator close-by-pass-bulb-completely signal IDL, the motor close-by-pass-bulb-completely signal MOFF, and the brake treading-in signal BRK of a digital signal are inputted at step 4200. Next, although vehicle speed signal processing is

performed at step 4300 Here, it is Fig. 5 (although it expresses [step 4220] processing which detects the interruption time interval by the output signal of sensor 35a whenever [wheel speed], and calculates VFR whenever [right-front-wheel-speed] [step 4210] and after this, since this example is the same also about also whenever [other wheel speed], it carries out an illustration abbreviation.). Vt, the drag control initial speed Vh, etc. are computed [whenever / right-front-wheel-speed / which was obtained by vehicle speed interrupt processing which synchronized with whenever / wheel speed / as showed / whenever / VFR and left-front-wheel-speed] whenever [required for control target speed-of-drive-wheel] from VFL, the right rear ring rate VRR, and the left rear ring rate VRL.
The detail of step 4300 finds the car rate V of the center of the right rear ring 31 and the left rear ring 33, i.e., the location of a differential gear 29, from a degree type at step 4310 by the rotational speed VFR, the rotational speed VFL of the forward left ring 37, and the rudder angle SA of the forward right ring 35 which are a coupled driving wheel, as shown in Fig. 6 .
V= [cosSA+ (B/2L) and sinSA]
- [(VFR+VFL) /2]
"L" shows the wheel base of a car and "B" shows the tread width of face of rear wheels 31 and 33 here.
Next, if the vehicle speed V and the 1st judgment rate KS are measured, it becomes V>=KS at step 4320 and it will become V<KS to step 4330, it will progress to step 4340. At step 4330, Vt is determined as V-(Vx target slip ratio S) whenever [drag target speed-of-drive-wheel], and it is determined as the Vt=V-1st offset rate Soff at step 4340. In addition, the 1st judgment rate KS is set up here so that it may become Soff=KSxS.
That is, the 1st offset rate Soff at least is controlled whenever [speed-of-drive-wheel] to continue rotating at a rate smaller than the vehicle speed to be shown in Fig. 7 .
If Vt is determined whenever [drag target speed-of-drive-wheel] at step 4330 or step 4340, and it becomes V<=KT about a car body V and the 2nd judgment rate KT at step 4350 as compared with a degree, to step 4360, if it becomes V<KT, it will progress to step 4370, and at step 4360, it will be determined as DORAKKU control initial speed Vh=V-Vx drag control initiation slip ratio H, and will be determined as the Vh=V-2nd offset rate Hoff at step 4370 to it. In addition, the 2nd judgment rate KT is set up here so that it may become Hoff=V- (KTxH).
According to the relative location [respectively as opposed to the 1st judgment rate KS or the 2nd judgment rate KT in Vt and the drag control initial speed Vh] of the vehicle speed V, the formulas differ whenever [drag target speed-of-drive-wheel]. Although this is [whenever / target speed-of-drive-wheel] desirable on the control by which setting up by [V-Vx target slip ratio S] or [V-Vx drag control initiation slip ratio H], respectively was stabilized if Vt or the DORAKKU control initial speed Vh has usually sufficient vehicle speed V Now, according to the fall of the vehicle speed V, the difference of Vt or the drag control initial speed Vh, and the vehicle speed V becomes small whenever [target speed-of-drive-wheel] gradually, and there is a possibility of producing the difficulty and the control error on control. For this reason, in being vehicle speed V<KS or V<KT, it sets up Vt or the drag control initial speed Vh whenever [target speed-of-drive-wheel] so that the minimum of a difference may be the 1st offset rate Soff or the 2nd offset rate Hoff. Therefore, as shown in Fig. 7 , when VRR and VRL become below the 2nd offset rate Hoff at least to the vehicle speed V whenever [speed-of-drive-wheel], it judges that the slip with excessive driving wheels 31 and 33 was produced, and the drag control initiation judging rate Vh is set up so that the drag control for controlling the slip may be started.
In addition, as a value of the constant under processing, it can set up with KS=50 km/h and KT=50 km/h, for example.
Moreover, drag control-objectives slip ratio S and drag control initiation slip ratio H which were mentioned above are changed not according to a fixed value but according to the steering angle SA. For example, it is set up as shown in Fig. 18. That is, during revolution, as compared with a rectilinear-propagation condition, slip ratio is stopped further, and it is set up so that a required side force may be acquired. Here, the steering angle SA is expressed with the value of the plus by "0" and anticlockwise rotation by minus and clockwise rotation in the rectilinear-propagation condition. If it does in this way, the transit which maintained the side force required at the time of revolution, and was stabilized will be secured.
As it is indicated in Fig. 19 as target slip ratio S and drag control initiation slip ratio H here, the side force is set as sufficient slip ratio. Therefore, drag control can be made to start before car transit becomes unstable by excessive engine brake.
At the following steps 4380 and 4390, processing for removing vibration produced from Signals VRL and VRR in friction of a tire and a road surface whenever [on either side speed-of-drive-wheel] is performed.

This vibration serves as about 30 - 50ms of periods in many cases, and since it is not a component showing car behavior, when performing high control of precision, it must be removed. In this example, nozzle removal is carried out using the band reject filter which removes only a 10-30Hz field. In addition, when it corresponds only at the time of start acceleration, processing except all of a component 10Hz or more may be performed. In this way, the driving wheel signal of the obtained right and left is set to VRLF and VRRF, respectively, finally difference with the last values VRLFO and VRRFO of VRLF and VRRF is taken and asked for the left driving wheel acceleration GVRL and the right driving wheel acceleration GVRR at step 4395, respectively, and vehicle speed signal processing is once ended.
It returns to Fig. 4 again, and at continuing step 4400, when an excessive slip is produced in the slip condition judging processing which showed the detail in Fig. 8 , processing which sets Flag FTS is performed. If Vt is compared the rate VRLF of the left rear ring (driving wheel) 33, and whenever [DORAKKU target speed-of-drive-wheel] and it becomes VRLF>Vt at step 4410 first, it will progress to step 4420. In step 4420, VRLF is compared the left rear ring hold rate XVRL and whenever [Hidari velocity-of-rear-wheel], and if it becomes XVRL=VRLF, the value of Counter CRL will be increased one at step 4450. If it becomes XVRL!=VRLF, the value of VRLF will be set as the left rear ring hold rate XVRL whenever [Hidari velocity-of-rear-wheel] at step 4430, and the value of Counter CRL will be set to 1 at step 4440. After steps 4440 and 4450 clears the initial deceleration GRL of a left driving wheel at step 4460, and it moves from it to right driving wheel processing of step 4520. Processing of these steps 4420-4460 is performing processing which holds VRLF as a left rear ring hold rate XVRT whenever [Hidari velocity-of-rear-wheel / at the time of the left rear ring rate VRLF descending and cutting Vt whenever / target speed-of-drive-wheel]. Of course, as long as this processing is repeated at sufficiently short spacing, since the left rear ring hold rate XVRL is [whenever / target speed-of-drive-wheel] equal to Vt, the Vt itself may be used whenever [target speed-of-drive-wheel], without suspending the left rear ring rate VRLF specially. Also in step 4520 mentioned later, it is the same.
After increasing the value of Counter CRL one at step 4480 if are judged with VRLF<=Vt at step 4410, and it progresses to step 4470, VRLF and the drag control initiation judging rate Vh are measured and it becomes VRLF>Vh, it progresses to step 4520.
If it becomes VRLF<=Vh, the value of VRLF will be set as the left driving wheel terminal velocity YVRL whenever [Hidari velocity-of-rear-wheel] at step 4490, and the initial deceleration GRL of a left driving wheel will be searched for like a bottom type from XVRL, YVRL, and CRL at the following step 4500. GRL= (XVRL-YVRL)/CRL Next, drag rate condition flag FTS is set and it progresses to step 4520. Processing of these steps 4490-4510 is performing processing which holds VRLF as a left driving wheel terminal velocity YVRL whenever [Hidari velocity-of-rear-wheel / at the time of the left rear ring rate VRLF descending further, and cutting the drag control initiation judging rate Vh]. Of course, as long as this processing is repeated at sufficiently short spacing, since the left driving wheel terminal velocity YVRL is equal to the drag control initiation judging rate Vh, the drag control initiation judging rate Vh itself may be used, without using the left rear ring rate VRLF specially. Also in step 4520 mentioned later, it is the same.
At continuing step 4520, while performing the same processing as the above-mentioned processing (steps 4410-4510) which followed the left rear ring 33 also about the right rear ring 31 and judging slip generating of the right rear ring 31, the deceleration GRR of the right rear ring in the decision time, i.e., the initial deceleration of a right driving wheel, is searched for. Finally the initial deceleration GFI is searched for at step 4530 from the initial deceleration GRL of a left driving wheel, and the initial deceleration GRR of a right driving wheel, and processing is once ended.
At return and the signal input base processing step 4000, initiation and termination of drag control at step 4600 are judged to the degree of the slip condition judging step 4400 in Fig. 4 . The detail is shown in the 9th drawing 9 Fig. The fail flag FF set when judged as unusual ** by another processing which judges the existence of abnormalities, such as a drive system of a throttle valve 7, at step 4610 first, and which is not illustrated is seen, and if set, since it is not appropriate to perform drag control at the time of abnormalities, at step 4660, the drag execution flag FT is reset and it once ends.
At step 4615 performed when the fail flag FF is reset, if the signal BRK of brake sensor 43a is ON, since it is operational status unsuitable to drag control, in order to end, it will progress to step 4660. If Signal BRK is off, at step 4620, the accelerator control input AA will be seen and it will compare with the control input decision value KA (this example KA= 1.5 degrees). Since it will not be the accelerator control input AA which engine brake produces AA>=KA if it becomes, it progresses to step 4660 and this processing is once finished. Moreover, if it becomes AA<KA, the drag execution flag FT will be seen at step 4630, and it will judge whether it is under [drag activation] ******.

When the drag execution flag FT is reset (i.e., when drag control is not performed until now), drag rate condition flag FTS is seen at step 4640. If it will mean that the conditions of drag control had been ready, and the drag execution flag FT will be set at step 4650, if drag rate condition flag FTS is set here, and drag rate condition flag FTS is reset, step 4650 will be bypassed without setting the drag execution flag FT, and this processing will once be ended.
Since the target throttle opening TH of the more than already needed is set up if the target opening THDRG is measured at the time of the target throttle opening TH which will be repeatedly computed by step 4670 at the throttle control base processing step 6000 mentioned later if the drag execution flag FT is already set at step 4630, and a drag and it becomes TH>THDRG, after resetting the drag execution flag FT at step 4680, it progresses to step 4690. If it becomes TH>=THDRG, drag rate condition flag FTS will be reset at step 4690, and this processing will once be finished.
Data and a flag required for drag control are prepared by the above signal input base processing step 4000, and then drag control using them is performed one by one with step 5000 of Fig. 3 , then step 6000.
First, the detailed contents of processing of the fuel-injection base processing step 5000 are shown in Fig. 10.
First, at step 5100, by the general approach, the basic pulse width of a fuel-injection pulse is decided, further, the basic pulse width is amended and fuel-injection pulse width TI is calculated from the engine-coolant water temperature THW and an intake-air temperature THA from the pressure-of-induction-pipe force PM and an engine speed Ne. And at the following step 5280, after computing ignition timing St based on various input signals, this processing is ended.
By the way, valve-opening processing of an injection valve 15 according to fuel-injection pulse width TI set by calculation of the engine speed Ne used by above-mentioned processing and above-mentioned processing is performed by the general engine rotation interruption (it generates every 30 degrees whenever [crank angle]) shown in Fig. 11. That is, by decision of step 5540, if the time interval from interruption is set as T1, and continues last time at step 5510, the inverse number to the engine speed Ne of step 5520T1 is computed, an injection initiation stage is judged at step 5530 and an initiation stage comes, if the fuel-injection pulse width T1 is not zero, at step 5550, only the fuel-injection pulse width T1 will open an injection valve 15, and a fuel will be injected to tee 3c of an inlet pipe 3.
The throttle control base processing step 6000 performed by the degree of step 5000 is explained based on Fig. 12. First, at step 6010, a interpolation operation is carried out and it asks for the data table stored like instantiation of the maximum throttle opening THMAX corresponding to an engine speed Ne of the 1st table in ROM50d.

第 1 表

Ne(rpm)	THMAX(度)
400	20
800	30
1200	30
2000	40
2800	50
3600	60
4400	70
5200	70
6000	80

This is for securing the responsibility of the throttle valve 7 at the time of clausilium actuation, as the point (THMAX) that an engine torque is saturated to throttle opening is searched for and a throttle valve 7 is not opened any more.
Let the smaller one of this maximum throttle opening THMAX and the target throttle opening THAA corresponding to the accelerator which becomes settled according to the accelerator control input AA be the target throttle opening TH at step 6020. At the following step 6030, the drag execution flag FT is investigated, and if the drag execution flag FT is set, and reset, it will progress to step 6040 6050. At step 6050 made under the situation that drag control is not performed, the drag beginning flag FTT by the throttle valve 7 is reset, then, the above-mentioned target throttle opening TH is made into the step motor target number of steps CMD at step 6060, and it progresses to step 6070. In this way, the usual throttle opening control is made.
At step 6040, if the drag beginning flag FTT is investigated and it is reset, it will be judged as the first time processing at the time of the drag control activation by the throttle valve 7, and the driving wheel torque TW current (at the time of judging it as slip generating) at step 6100 will be computed first.
Here, the processing in the driving wheel torque TW calculation step 6100 is shown in Fig. 13.
In step 6110, it interpolates and asks for the torque SACHU rate opening Tsut according to an engine speed Ne, and the zero torque opening Tzero from the map illustrated to the 2nd table first.

第２表

Ne	Tsut	Tzero
400	7	0
800	13	0
1200	15	1
1600	17	1.5
2000	20	2
2400	22	3
2800	23	4.5
3200	24	6
3600	25	7
4000	26	8
4400	28	9
4800	33	10.5
5200	38	12
5600	40	13
6000	43	14

Generally, the relation between the throttle opening of a gasoline engine and an engine torque is as being shown in Fig. 14, and torque will increase to it linearly, torque is saturated with still larger opening

(THMAX) than it, and however throttle opening zero (close by-pass bulb completely) to a certain opening (torque SACHU rate opening Tsut) may enlarge opening more than it, torque will not increase to it. Moreover, if rotational speed Ne is made high, the inclination of a linear part will become small, and the throttle opening with which torque is saturated becomes large.
Therefore, at step 6130 mentioned later, the current driving wheel torque TW will be searched for based on the relation of the straight-line part of the throttle opening of an above-mentioned gasoline engine, and an engine torque.
Since it is such order, in this example, it asks for the zero torque opening Tzero and the torque SACHU rate opening Tsut for every engine-speed Ne by experiment beforehand, and has stored in ROM50d by using as a map relation with the engine speed Ne, the zero torque opening Tzero, and the torque SACHU rate opening Tsut which become settled according to the experimental result. And at step 6110, according to an engine speed Ne, a interpolation operation is carried out and it specifically asks for the torque SACHU rate opening Tsut and the zero torque opening Tzero from the above-mentioned map.
Next, at step 6120, the relation between the current throttle opening TA and the torque SACHU rate opening Tsut is judged, if it is Tsut>TA, the current driving wheel torque TW will be computed at step 6130 according to the above-mentioned straight-line relation using the engine torque (saturation torque MAXT) in the torque SACHU rate opening Tsut, the zero torque opening Tzero, and the current throttle opening TA and the current maximum throttle opening like a bottom type, and this processing will once be ended.
TW=(TA-Tzero) andMAXT/(Tsut-Tzero)
Moreover, if it is Tsut<=TA, this processing will once be ended at step 6140 by making current driving wheel torque TW into the saturation torque MAXT.
In addition, since an engine torque changes with air density, you may make it amend the saturation torque MAXT according to the factor (air temperature, atmospheric pressure) from which air density changes, although constant value is sufficient as the saturation torque MAXT in above-mentioned driving wheel torque TW calculation processing.
Again, after processing of step 6100 finishes in Fig. 12, like a bottom type, using the current (at the time of judging it as slip generating) driving wheel torque TW searched for at step 6100, the initial value of the integral control term FI used by calculation of the target driving torque FX mentioned later is calculated, and it substitutes for the last value FIO of a control term at step 6200.
FIO<-KtxTW Kt is a predetermined multiplier here.
After finishing processing of step 6200, it describes that set the drag beginning flag FTT at continuing step 6090, and processing of the drag control beginning was completed, and progresses to step 6300. Moreover, if Flag FTT is set at step 6040, it will bypass without processing the above-mentioned steps 6100, 6200, and 6090, and will progress to step 6300. That is, steps 6100, 6200, and 6090 are performed only at once immediately after setting the traction execution flag FT.
At step 6300, the target driving torque FX is searched for by proportionality / integral processing (PI processing). It seems that it is shown in Fig. 15 in detail. The difference of VRLF and the larger one of the right rear ring rates VRRF is searched for whenever [Hidari velocity-of-rear-wheel / who asked for whenever / target speed-of-drive-wheel / at Vt and the car-body signal-processing step 4300 by step 6310 first], and deflection DV costs whenever [speed-of-drive-wheel]. At step 6320, in order to search for the proportional control term FP, deflection DV is applied to proportional gain KFP. At step 6330, in order to search for the integral control term F1, the product of the integral gain KFI and deflection DV is added to the last value FIO of the integral control term F1. The integral control term FI which added FP and FI, searched for the target driving torque FX at step 6340, and was searched for at step 6330 by step 6350 is made into a value FIO last time. It judges at step 6360 to the appearance from which the target driving torque FX finally searched for at the front step 6340 does not become a forward value. If it is FX>=0, target driving torque FX will be set to 0 at step 6370, the phenomenon in which a car moves from moderation to acceleration in the reverse condition at the time of engine brake is prevented, and this flow chart is once ended.
Then, at return and step 6400, the drag target opening THDRG is computed to Fig. 12 from the target driving torque FX which was able to be found at the above-mentioned step 6300. The drag target opening THDRG is computed based on the processing shown in Fig. 16 using the linearity of the engine torque and throttle opening which also showed this calculation processing in above-mentioned Fig. 14. At step 6410, the torque SACHU rate opening Tsut and the zero torque Tzero are first searched for based on an engine speed Ne like step 6110 of the driving wheel torque TW calculation step 6100 of Fig. 13. At step 6420, it asks for the gear location GP based on the output signal from gear location sensor 27a, and gear ratio

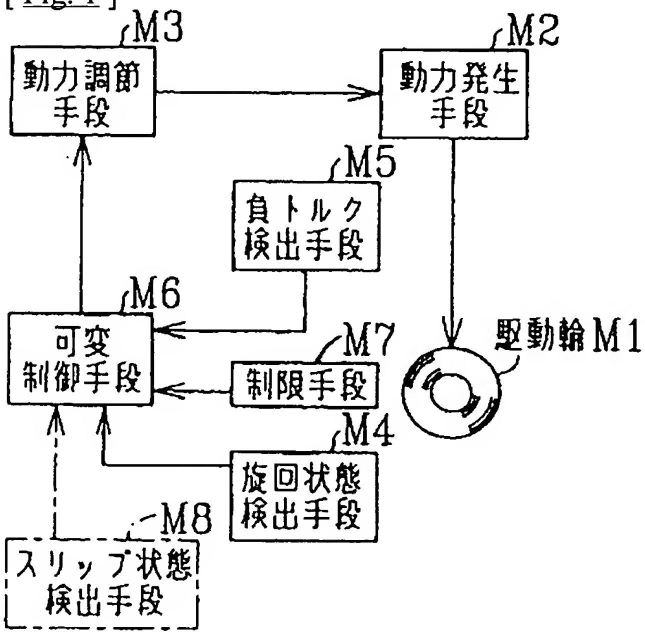
TSHFT is calculated from the location. At step 6430, it asks for the output rotational speed of the output side of a change gear 27 from whenever [speed-of-drive-wheel], (the right rear ring rate VRRF, the left rear ring rate VRLF) and the gear ratio of a differential gear 29, and asks for the torque conversion rate RTOR of a torque converter 25 from the ratio of this output rotational speed and engine speed Ne. And at step 6440, while carrying out linear transformation of the target driving torque FX by Tsut and Tzero which were calculated at the above-mentioned step 6410, it amends by TSHFT and RTOR which were calculated at steps 6420 and 6430, the drag target opening THDRG is defined, and this processing is once ended.
After finishing processing of return and step 6400 to Fig. 12, it progresses to step 6095. At step 6095, the target opening THDRG for which it asked is set to the target step CMD, and it progresses to step 6070. If this processing is once ended and both are in agreement after performing processing which starts motorised interruption at step 6080, if current [of Rota of the step motor 9 used in case the target number of steps CMD and a step motor 9 are driven at step 6070] compares real number-of-steps POS which shows a value and both differ, it will bypass without processing step 6080 and this processing will once be ended.
since an excitation phase is first updated according to the last setup at step 6081 as the above-mentioned motorised interruption (step 6080) shows to Fig. 17 -- step 6082 -- real number-of-steps POS -- the renewal of an excitation phase -- responding -- an increment -- or a decrement is carried out. That is, only "1" increases or decreases real number-of-steps POS so that the location and real number-of-steps POS of Rota may be made in agreement. If the target step CMD is compared with real number-of-steps POS and it is in agreement at step 6083, prohibition processing of this motorised interruption will be performed at step 6084, and rotation of a step motor 9 will be stopped. As a next excitation phase and interrupt time of day are set at steps 6085 and 6086 if , and an excitation phase is updated again, this processing is once ended.
Since this example is constituted in this way, and a throttle valve 7 is controlled in the open direction, the output torque of an engine 1 goes up, negative torque decreases suitably and it is maintained by moderate slip ratio when a slip of driving wheels 31 and 33 is likely to become superfluous in engine brake, the stability of car transit is secured. Furthermore, since drag control-objectives slip ratio S and drag control initiation slip ratio H are changed according to the steering angle SA, during revolution, as compared with a rectilinear-propagation condition, slip ratio can be stopped further, and the fall of a side force can be controlled. Therefore, even if engine brake and revolution lap, the transit which maintained the required side force and was stabilized is secured. In equipment, using the equipment of the conventional traction control as it is, a program is only changed only in software and drag control can be realized.
Although it asks for the driving wheel acceleration GVRL and GVRR at said step 4395 of Fig. 6 and the driving wheel deceleration GRL, GRR, and GFI is searched for at steps 4500, 4520, and 4530 of Fig. 8 , if this is searching for the driving wheel acceleration GVRL and GVRR and the driving wheel deceleration GRL, GRR, and GFI and they are restricted to drag control of this example in order to use for other processings which are not illustrated, it will be the processing which does not need to be performed. it seems that it is shown in Fig. 21 if slip condition judging processing of Fig. 8 is simplified especially -- ** -- it becomes. That is, although nothing will be made noting that the excessive slip by engine brake is not produced if both VRLF and VRRF are [whenever / both velocity-of-rear-wheel] larger than the drag control initial speed Vh (steps 7010 and 7030), if either the left rear ring rate VRLF and the right rear ring rate VRRF become below the drag control initial speed Vh (steps 7010 and 7030), drag rate condition flag FTS will be set (steps 7020 and 7040), and it will once end. it seems that future processings were mentioned above -- ** -- it becomes.
In addition, VRLF, VRRF, and a slip condition are predicted whenever [speed-of-drive-wheel] from downward extent of the driving wheel acceleration GVRL and GVRR, or rise extent of the driving wheel deceleration GRL, GRR, and GFI, and it may be made to perform drag control at an early stage.
In the above-mentioned example, rear wheels 31 and 33 correspond to a driving wheel M1, and an engine 1 corresponds to the dynamogenesis means M2. A throttle valve 7 corresponds to the power accommodation means M3, and rudder angle sensor 39a corresponds to a revolution condition detection means. ECU50 corresponds to the negative torque detection means M5, the adjustable control means M6, the limit means M7, and the slip condition detection means M8. Step S4600 mainly corresponds to the processing as a negative torque detection means M5 among the processings which ECU50 performs. throttle control base processing of step S6000 -- mainly -- the processing as an adjustable control means M6 -- corresponding -- step S -- 6360 and 6370 mainly correspond to the processing as a limit means M7, and step S4400 mainly corresponds to the processing as a slip condition detection means M8.
In addition, in the above-mentioned example, although the engine output control was based on the throttle valve, it may not be based on a throttle valve, but may adjust and carry out the output control of the back

pressure of an engine 1 by the exhaust air throttle valve. In addition, an engine output control may be performed by ignition timing control. As long as it is a diesel power plant, an engine output control may be performed by controlling fuel oil consumption or fuel injection timing.
Moreover, in the electric vehicle except an internal combustion engine etc., drag control can be performed by control of the amount of supply voltages, and this is also one embodiment of this invention.
in the above-mentioned example, negative torque has arisen as a negative torque detection means M5 -- from extent of an accelerator control input -- having judged (step 4620) -- Since you may judge with negative torque having arisen, in addition the torsion of the output shaft of an engine 1 becomes reverse compared with the time of the usual transit at the time of engine brake when the opening of a throttle valve 7 is below predetermined opening Negative torque generating is detected from the inversion of the torsion, and it is good also as decision conditions for drag control initiation.

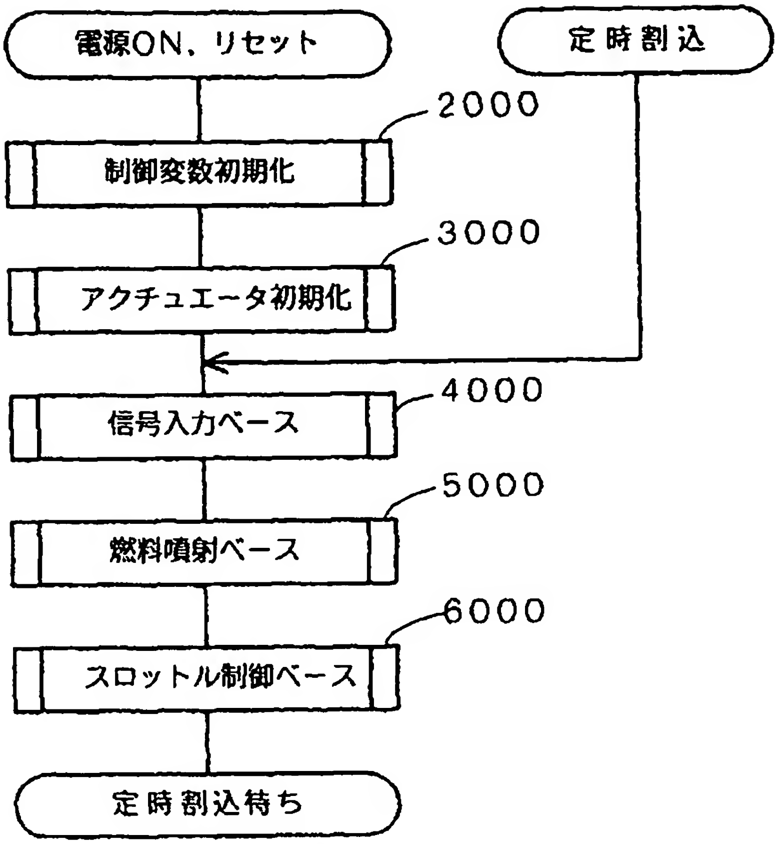
[Translation done.]

DRAWINGS

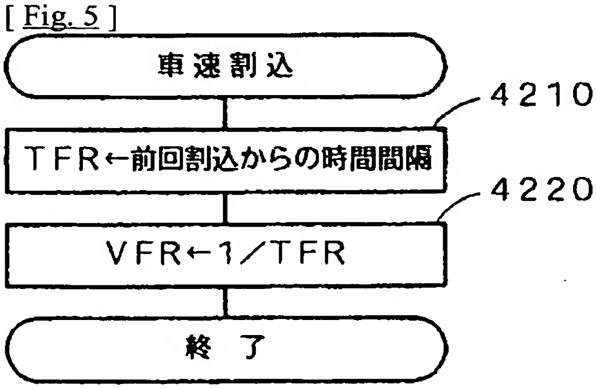
[Fig. 1]



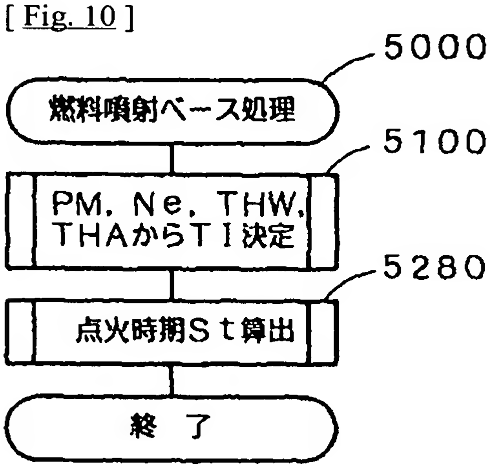
[Fig. 3]



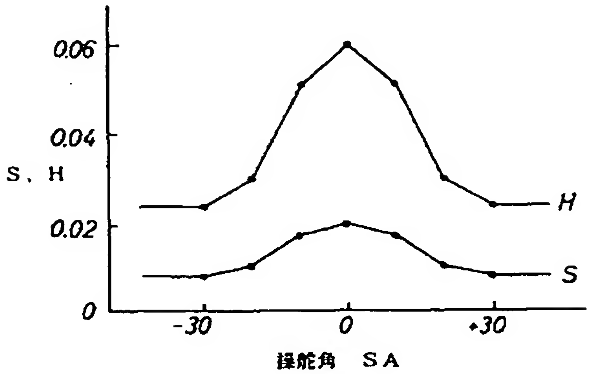
[Fig. 5]



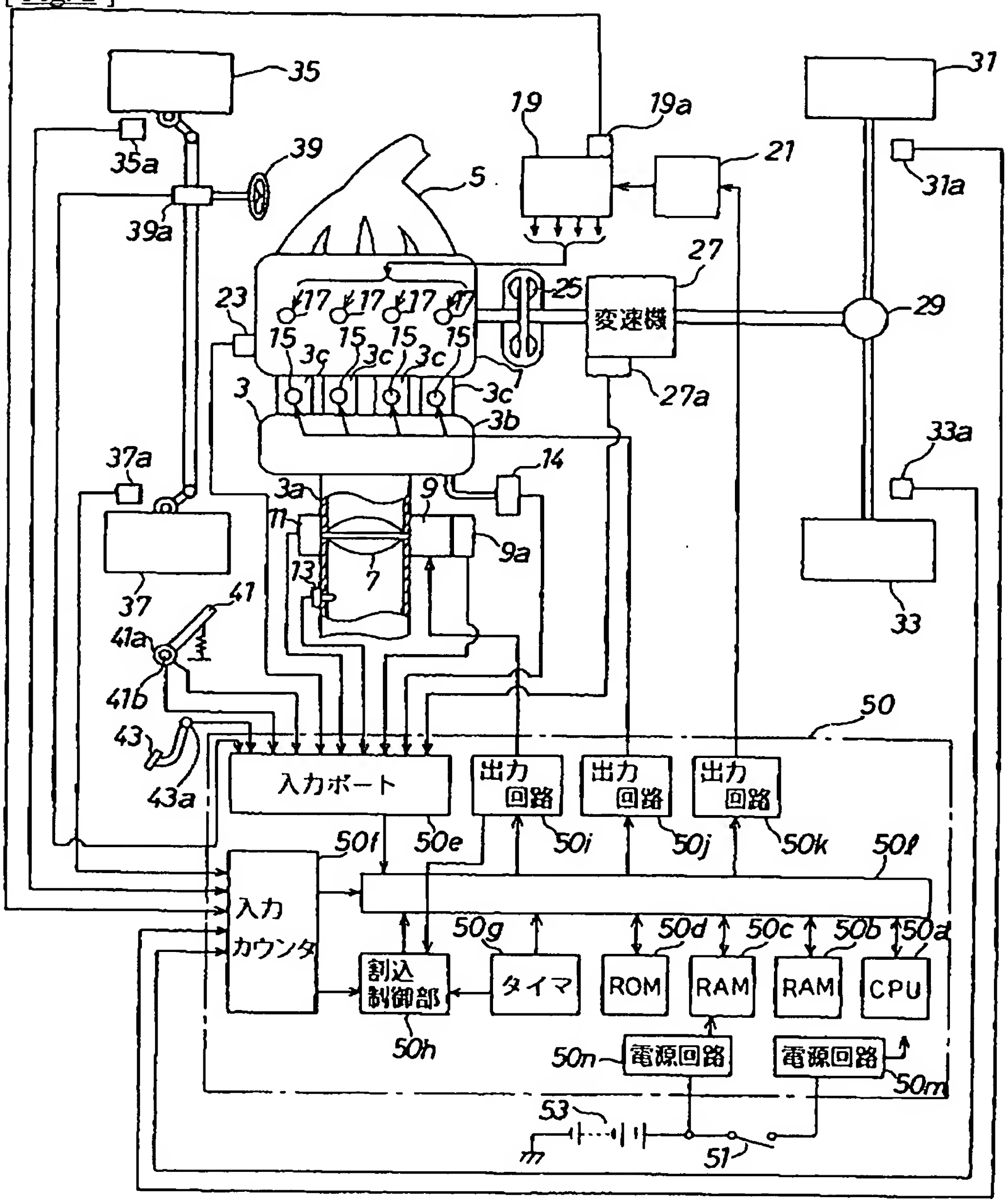
[Fig. 10]



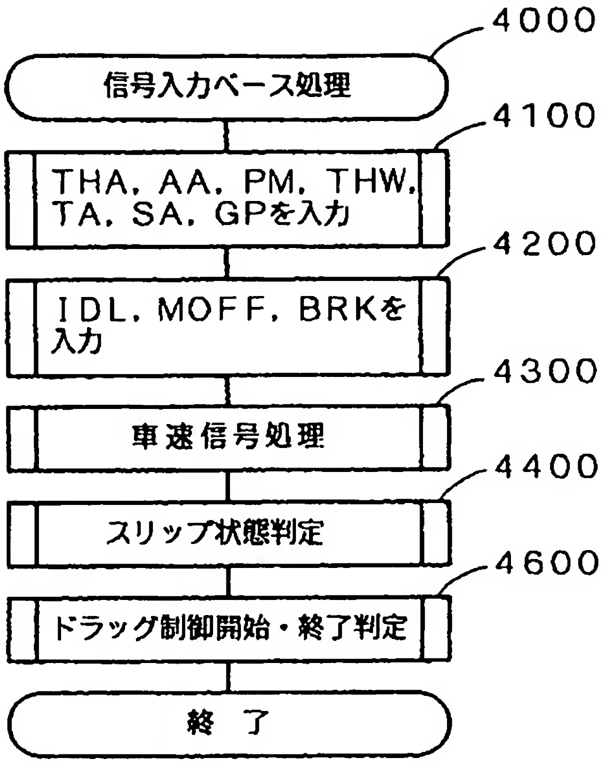
[Fig. 18]


0.06
0.04
S、H
0.02
0
H
S
-30
0
+30
操舵角 SA

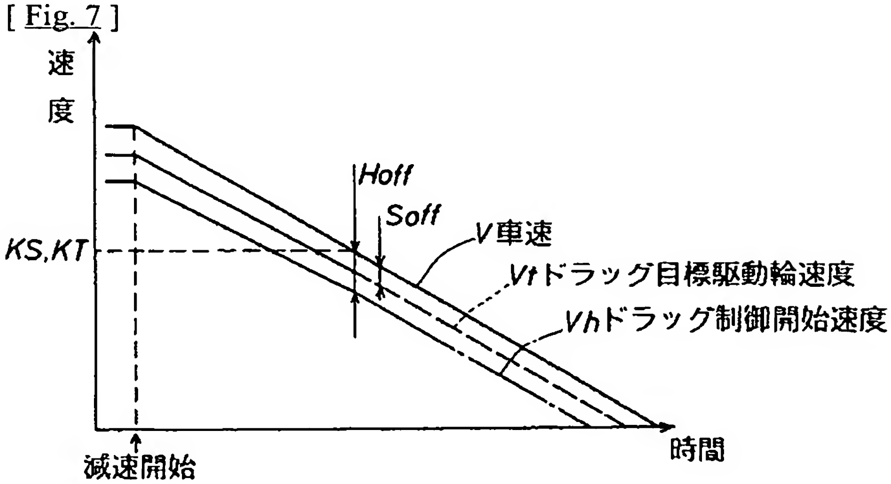
[Fig. 2]


35
35a
39
39a
5
19
19a
21
31
31a
27
23
17
25
変速機
29
15
3c
3
3b
27a
37a
14
33a
3a
9
11
9a
7
13
37
41
41a
41b
33
43
43a
50
入力ポート
出力回路
出力回路
出力回路
50f
50e
50i
50j
50k
50l
入力カウンタ
50g
50d
50c
50b
50a
割込制御部
タイマ
ROM
RAM
RAM
CPU
50h
50n
電源回路
電源回路
50m
53
51

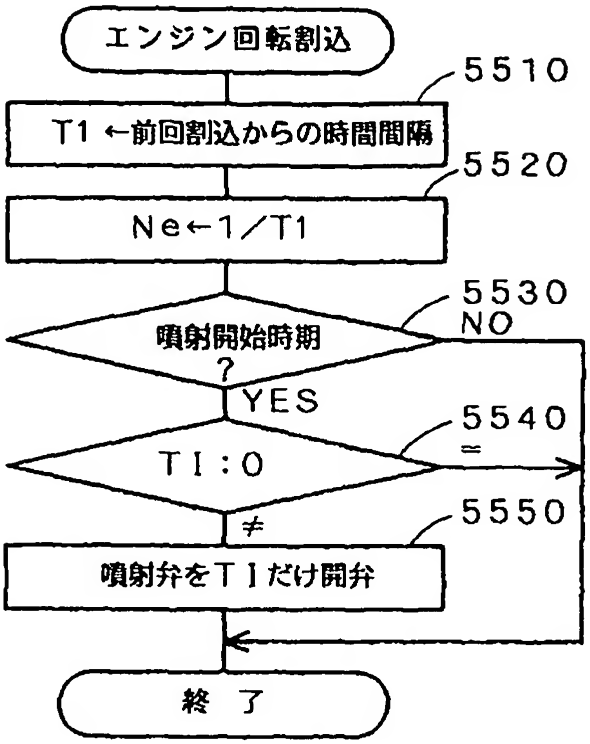
[Fig. 4]


4000
信号入力ベース処理
4100
THA, AA, PM, THW, TA, SA, GPを入力
4200
IDL, MOFF, BRKを入力
4300
車速信号処理
4400
スリップ状態判定
4600
ドラッグ制御開始・終了判定
終 了

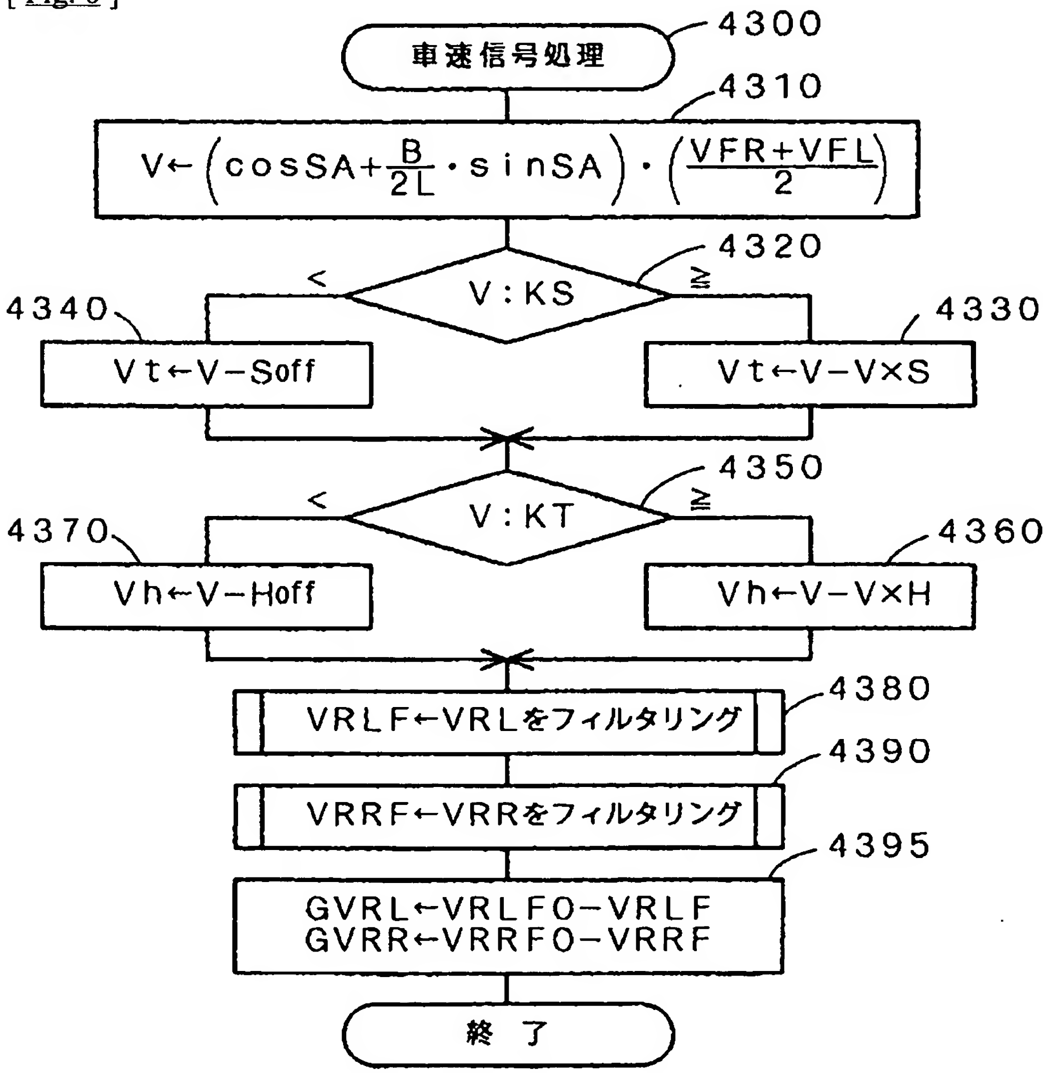
[Fig. 7]


速度
Hoff
Soff
V車速
KS,KT
Vtドラッグ目標駆動輪速度
Vhドラッグ制御開始速度
減速開始
時間

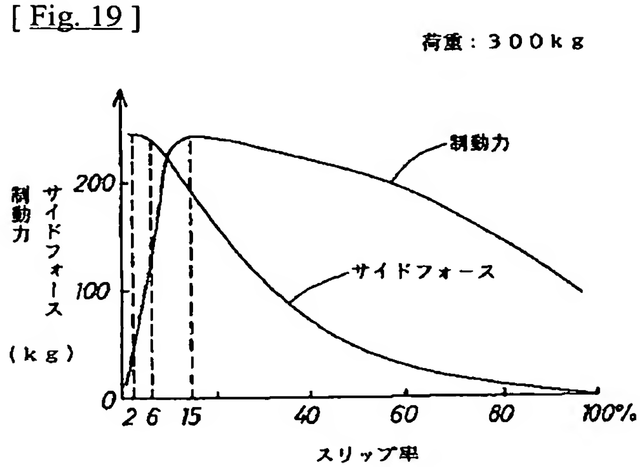
[Fig. 11]


エンジン回転割込
5510
T1 ←前回割込からの時間間隔
5520
Ne←1/T1
5530
NO
噴射開始時期?
YES
5540
TI:0
=
≠
5550
噴射弁をTIだけ開弁
終了

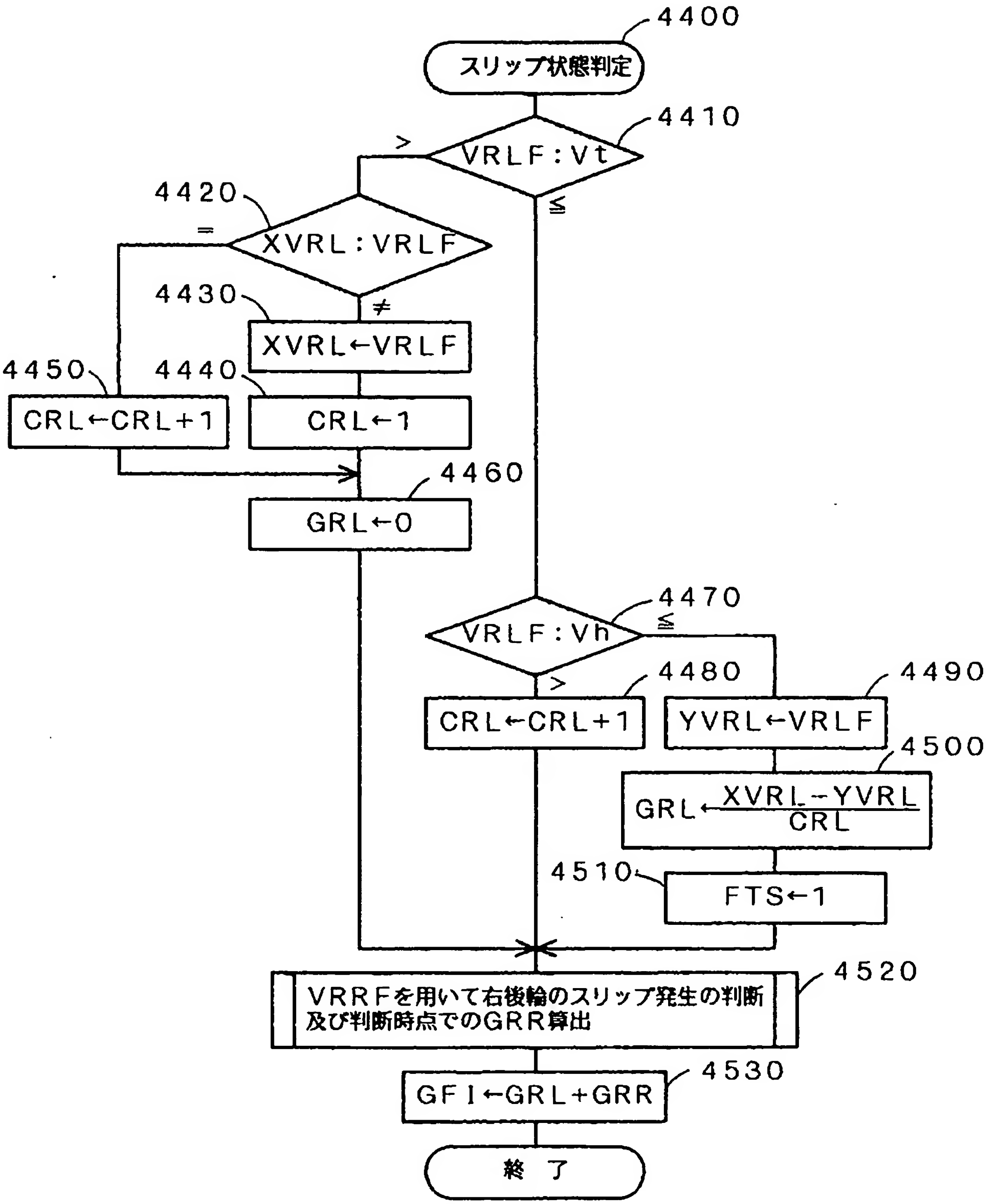
[Fig. 6]


4300
車速信号処理
4310
V←(cosSA+B/2L・sinSA)・(VFR+VFL/2)
4320
<
V:KS
≧
4340
4330
Vt←V−Soff
Vt←V−V×S
4350
<
V:KT
≧
4370
4360
Vh←V−Hoff
Vh←V−V×H
4380
VRLF←VRLをフィルタリング
4390
VRRF←VRRをフィルタリング
4395
GVRL←VRLF0−VRLF
GVRR←VRRF0−VRRF
終了

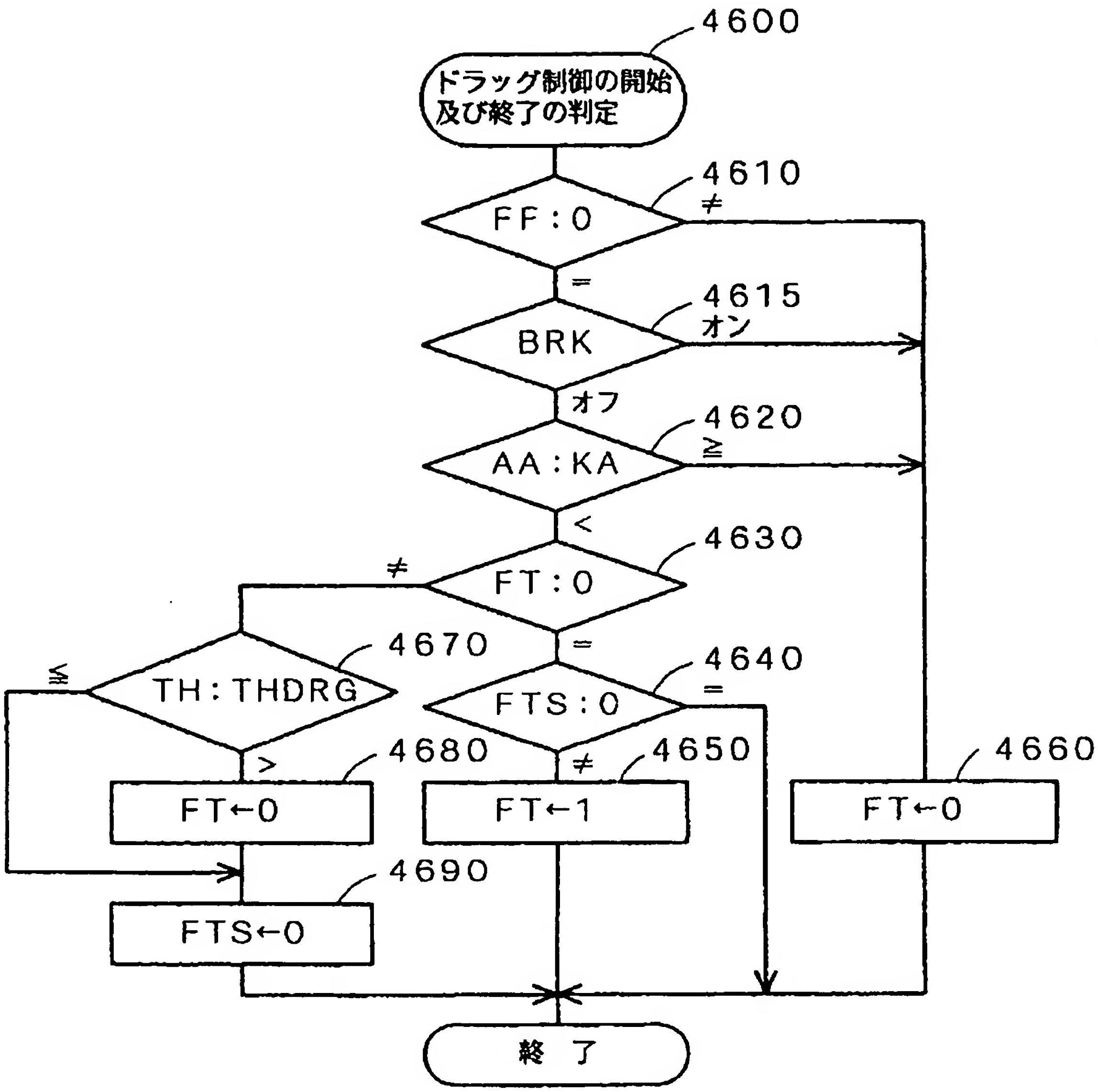
[Fig. 19]


荷重：３００ｋｇ
制動力
サイドフォース
制動力
サイドフォース
（ｋｇ）
200
100
0
2
6
15
40
60
80
100%
スリップ率

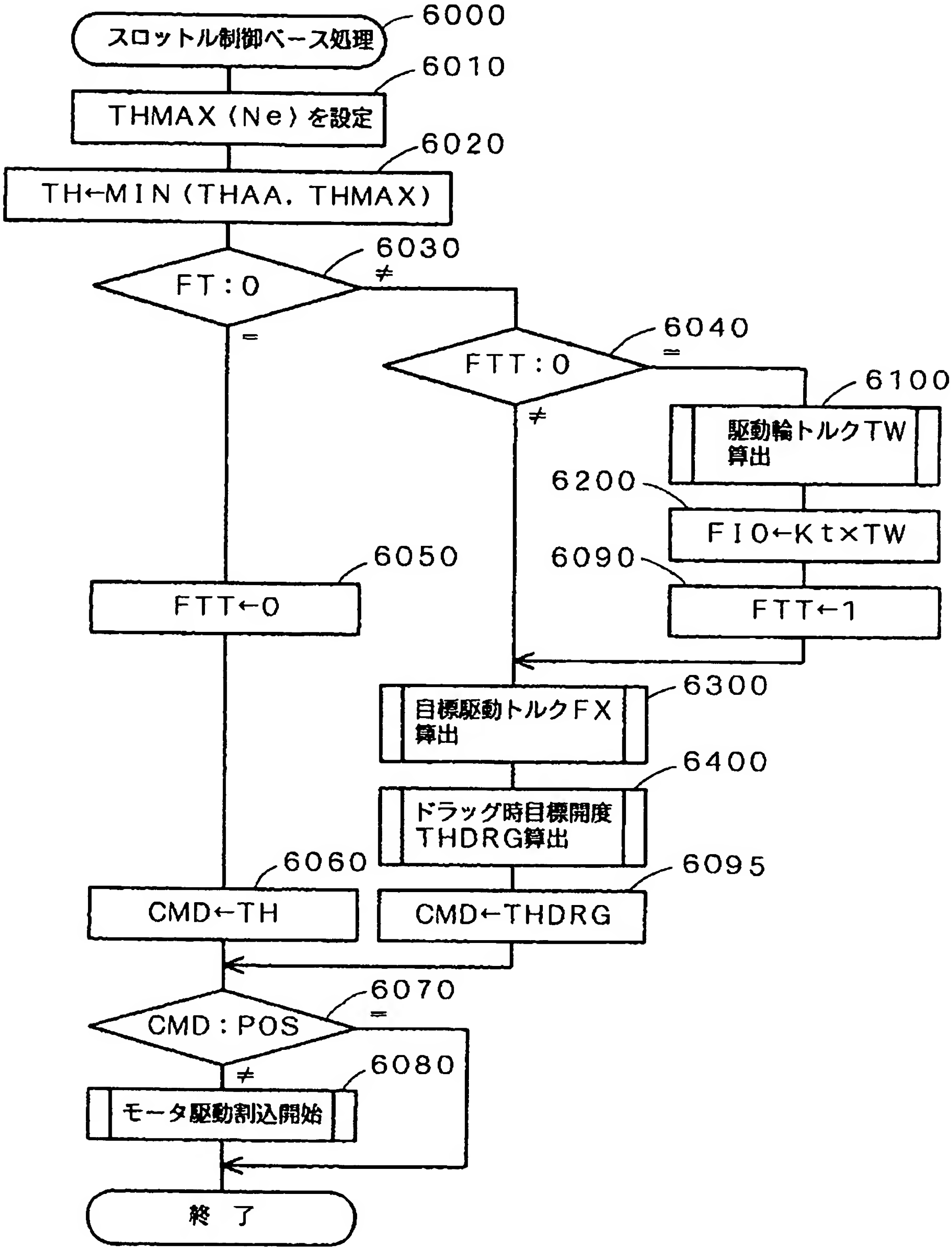
[Fig. 8]


4400
スリップ状態判定
4410
VRLF：Vt
>
≦
4420
XVRL：VRLF
=
≠
4430
XVRL←VRLF
4450
CRL←CRL+1
4440
CRL←1
4460
GRL←0
4470
VRLF：Vh
≦
>
4480
CRL←CRL+1
4490
YVRL←VRLF
4500
GRL←(XVRL－YVRL)/CRL
4510
FTS←1
4520
VRRFを用いて右後輪のスリップ発生の判断及び判断時点でのGRR算出
4530
GFI←GRL+GRR
終了

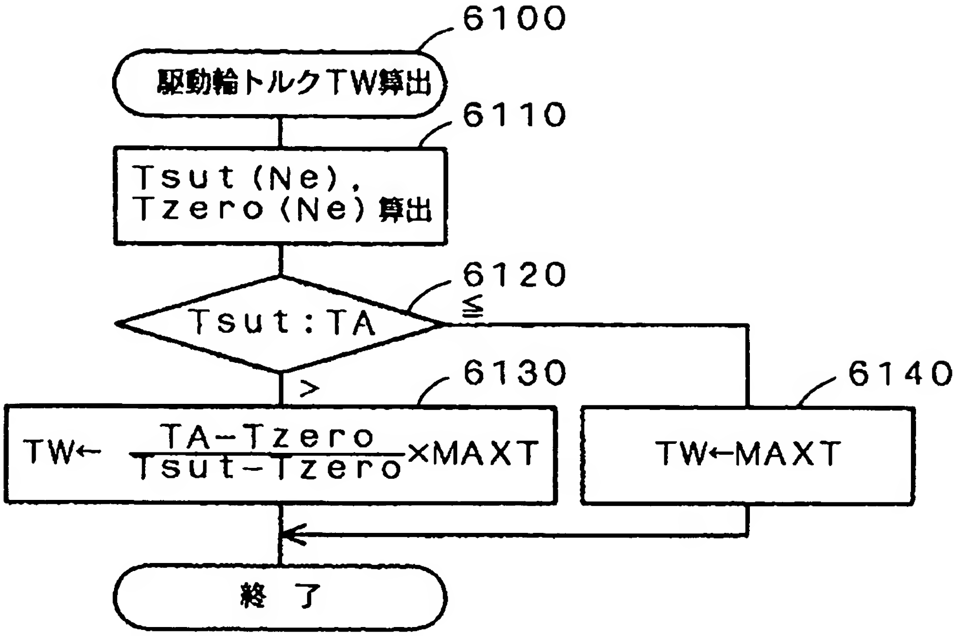
[Fig. 9]


4600
ドラッグ制御の開始及び終了の判定
4610
FF：0
≠
=
4615
BRK
オン
オフ
4620
AA：KA
≧
<
4630
FT：0
≠
=
4670
TH：THDRG
≦
>
4640
FTS：0
=
≠
4680
FT←0
4650
FT←1
4660
FT←0
4690
FTS←0
終 了

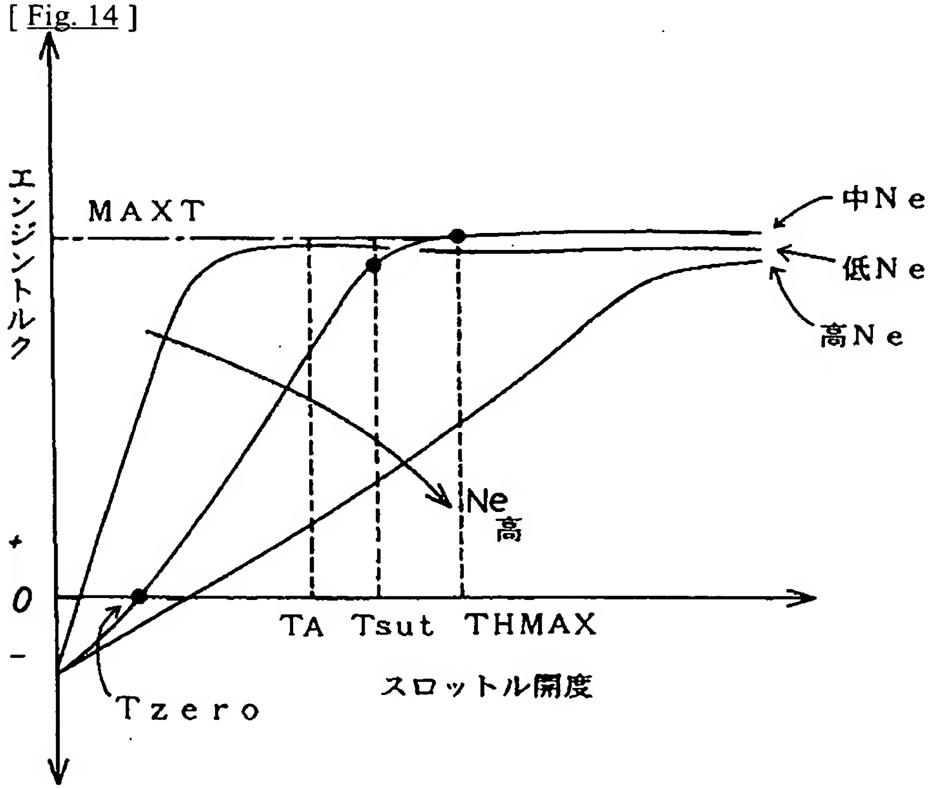
[Fig. 12]


6000
スロットル制御ベース処理
6010
THMAX（Ne）を設定
6020
TH←MIN（THAA，THMAX）
6030
FT：0
≠
=
6040
FTT：0
=
≠
6100
駆動輪トルクTW算出
6200
FI0←Kt×TW
6090
FTT←1
6050
FTT←0
6300
目標駆動トルクFX算出
6400
ドラッグ時目標開度THDRG算出
6060
CMD←TH
6095
CMD←THDRG
6070
CMD：POS
=
≠
6080
モータ駆動割込開始
終　了

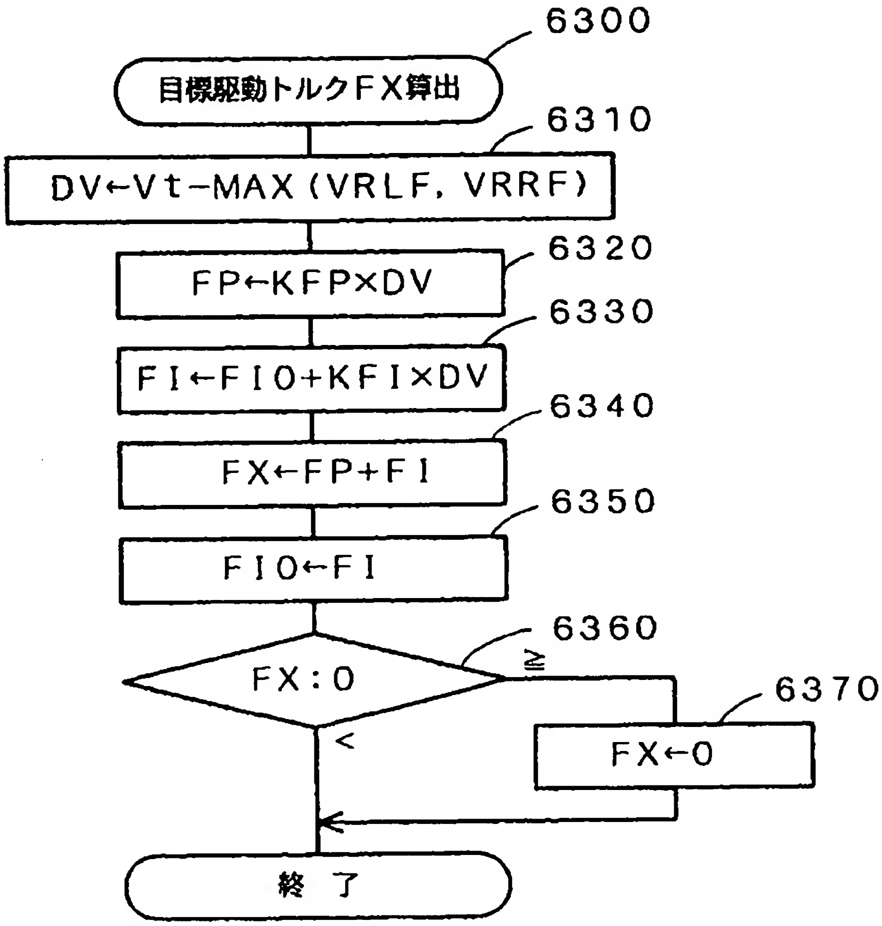
[Fig. 13]


6100
駆動輪トルクTW算出
6110
Tsut (Ne),
Tzero (Ne) 算出
6120
≦
Tsut : TA
>
6130
TW← $\frac{TA-Tzero}{Tsut-Tzero}$ ×MAXT
6140
TW←MAXT
終 了

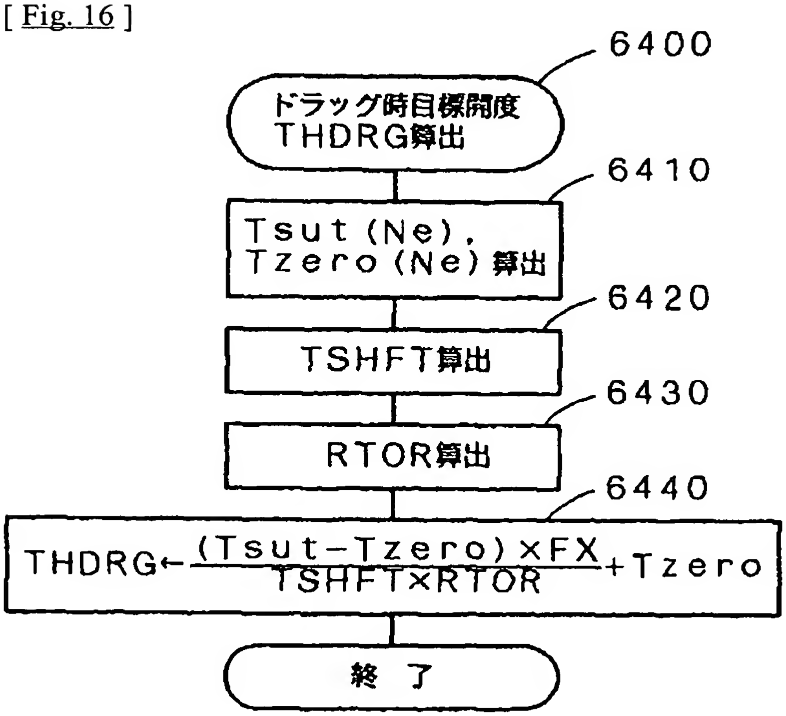
[Fig. 14]


エンジントルク
MAXT
中Ne
低Ne
高Ne
Ne
高
+
0
-
TA
Tsut
THMAX
Tzero
スロットル開度

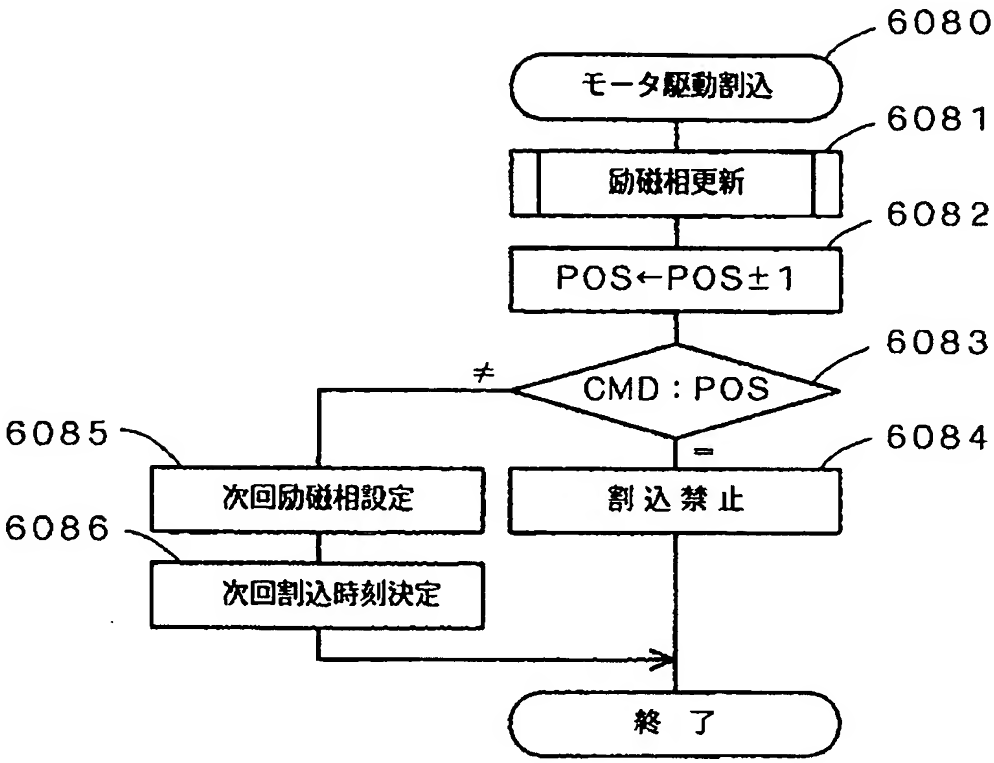
[Fig. 15]


6300
目標駆動トルクFX算出
6310
DV←Vt−MAX (VRLF, VRRF)
6320
FP←KFP×DV
6330
FI←FI0+KFI×DV
6340
FX←FP+FI
6350
FI0←FI
6360
FX : 0
≧
<
6370
FX←0
終 了

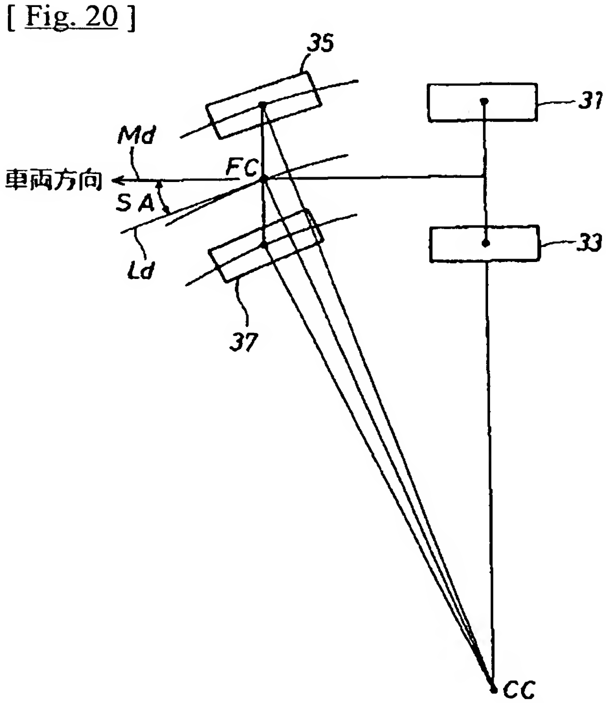
[Fig. 16]


6400
ドラッグ時目標開度
THDRG算出
6410
Tsut (Ne),
Tzero (Ne) 算出
6420
TSHFT算出
6430
RTOR算出
6440
THDRG←(Tsut−Tzero)×FX / TSHFT×RTOR +Tzero
終 了

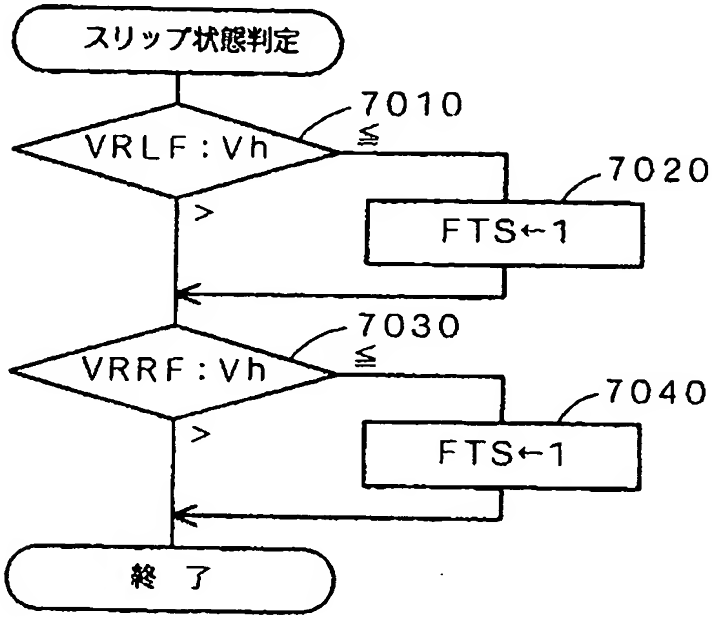
[Fig. 17]


6080
モータ駆動割込
6081
励磁相更新
6082
POS←POS±1
6083
CMD : POS
≠
=
6084
割 込 禁 止
6085
次回励磁相設定
6086
次回割込時刻決定
終 了

[Fig. 20]


35
31
Md
車両方向
FC
SA
Ld
33
37
CC

[Fig. 21]



[Translation done.]

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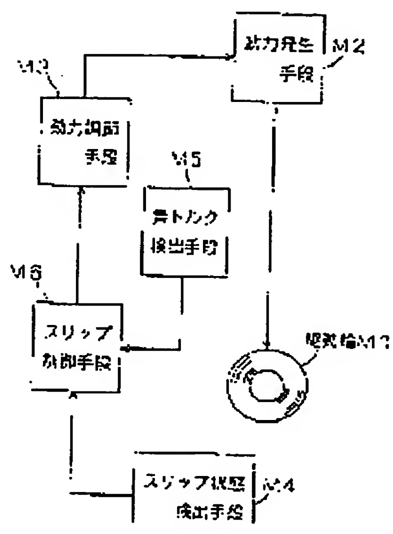
HARA MITSUO
KAMIO SHIGERU
TAKAO MITSUNORI

(54) VEHICLE SLIP CONTROL DEVICE

(57)Abstract:
PURPOSE: To suppress an excessive slip by adjusting a power adjusting means controlling a drive wheel for its detected slip condition to a predetermined condition when the drive wheel is detected for its negative torque generated.
CONSTITUTION: Power from a power generating means M2 is transmitted to a drive wheel M1 running a vehicle. Reversely when the power is decreased, negative torque is generated in the drive wheel M1 by various losses in the power generating means M2, here it generates an engine brake providing possibility of generating an excessive slip on a low friction road. Accordingly, when the negative torque is detected in a detecting means M5, a slip control means M6 adjusts a power adjusting means M3 controlling power generated by the power generating means M2 and a slip condition of the drive wheel M1 to a predetermined condition. Thus stabilization can be contrived of the running vehicle by suppressing the excessive slip caused by the engine brake.



LEGAL STATUS
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[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
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(54)【発明の名称】　車両スリップ制御装置

(57)【特許請求の範囲】

【請求項１】乗員により踏み込み調整されるアクセルペダルと、
前記アクセルペダル対する乗員の踏み込み操作状態を電気的信号に変換する信号変換手段と、
車両に搭載され、該車両を駆動輪を介して走行させるための動力を発生する動力発生手段と、
前記信号変換手段によって変換された前記電気的信号に応じて、前記動力発生手段の動力発生量を調節する動力調節手段と、
前記車両の旋回状態を検出する旋回状態検出手段と、
前記動力発生手段が前記車両の減速方向である負のトルクを前記駆動輪に与えていることを検出する負トルク検出手段と、
前記負トルク検出手段にて前記負のトルクが検出されている場合、前記旋回状態検出手段の検出結果である前記車両の旋回状態の度合が大きければ大きいほど、前記動力発生量の調節量を、前記車両の減速方向である負のトルクを小さくする方向へ制御するように前記動力調節手段を実行して前記動力発生量の調節量を可変する可変制御手段と、
前記可変制御手段にて前記動力発生量の調節量可変制御がなされている場合に、前記駆動輪に与えられる動力が実質的に正のトルクとはならないように制限する制限手段と、
を備えることを特徴とする車両スリップ制御装置。

【請求項２】請求項１に記載の車両スリップ制御装置において、
更に、
前記可変制御手段は、前記動力調節手段の実行の際に、

下は、車両旋回状態の度合に応じて変化するが、負トルク検出手段により負トルクが検出されている際には、可変制御手段により旋回状態の大きさに応じて動力発生量の調節を行う。この際、リンクレススロットルではアクセルペダルと動力調節手段の具体的であるスロットル弁との間が単に電気的信号によって連絡されていて、機械的なリンク機構が存在しないため、アクセルペダルに違和感を生じさせず、且つスロットル弁の全開から全閉までを可変制御手段に伴い動力調節手段により調節することが実質的に可能である。よって、負トルクと旋回状態とを鑑みたエンジン出力制御における制御性が非常に高い。また、制限手段によって、実質的に駆動輪に与えられる動力が正のトルクとならないようにすれば、何らかの原因で車両が減速から加速へと逆の状態に転じる減少を防止でき、一層安定した走行状態を確保できる。なお、スロットル弁が実質的に全閉から全開まで制御可能であれば、制限手段によって正のトルクとならないように調節する際等においても制御性が高まるというメリットがある。

また、負トルクと旋回状態とを鑑みたエンジン出力制御を可変制御手段によって行う際に、トラクション制御中において実行されるようにすれば、加速スリップ制御に伴う負トルクによるスリップ状態と、旋回に伴うスリップ状態との双方を鑑みたエンジン出力の制御が実現できる。この際、トラクション制御が実行されるのは、通常車両発進時である場合が多く、この車両発進時における加速スリップは非常に大きくなる場合が多い。これは、車両の停車状態から発進の際のアクセルペダルの踏み込みは、走行時に比べて比較的正確でないことが多く、たとえば現状が停車状態であれば車両が最も安定している状態であり、この状態におけるペダル踏み込みに対する注意度と、停車中に比べれば安定感が低い走行中のアクセル操作に対する注意度とは異なるからである。よって、このトラクション制御中における負トルクは非常に大きい場合が考えられ、トラクション制御中において負トルクと旋回状態とを双方鑑みたエンジン出力制御を実行することによって、最も効果的に車両の安定性を確保することができる。

第２図は本発明車両スリップ制御装置の一実施例をあらわす概略構成図である。なお、以下、負のトルクあるいは負トルクと表現しているのは、前述したごとく内燃機関１から駆動輪（右後輪31,左後輪33）に与えられる車両を減速する方向のトルクを表している。

内燃機関（以下単にエンジンという。）１は、火花点火式の４気筒ガソリンエンジンであって、車両に搭載されている。エンジン１には吸気管３及び排気管５が接続されている。吸気管３は図示しないエアクリーナに接続された集合部3aと、この集合部3aと接続されたサージタンク3bと、サージタンク3bからエンジン１の各気筒に対応して分岐した分岐部3cとからなる。

集合部3aにはエンジン１に吸入される空気量を調節してエンジン１で発生される出力を調節するためのスロットル弁７が設けられている。このスロットル弁７の弁軸はこのスロットル弁７の開度を調節するステップモータ９とスロットル弁７の開度を検出するスロットルセンサ11とに連結されている。

尚、ステップモータ９にはモータ９の全閉位置を検出するモータ全閉センサ9aが設けられている。

また集合部3aのスロットル弁７の上流位置に吸気温度を検出する吸気温センサ13が設けられている。

サージタンク3bには吸気管３内の圧力を検出する吸気管圧力センサ14が設けられており、また各分岐部3cには分岐部3c内に燃料を噴射する電磁式燃料噴射弁15が各々設けられている。

またエンジン１には各気筒に対応して吸入された混合気を点火するための点火プラグ17が設けられている。この点火プラグ17は高圧コードを介してディストリビュータ19と接続されており、このディストリビュータ19はイグナイタ21と電気的に接続されている。そして上記ディストリビュータ19にはエンジン回転に同期した信号を出力する回転センサ19aが設けられている。

またさらにエンジン１にはエンジン１を冷却する冷却水の温度を検出する水温センサ23が設けられている。

エンジン１で発生された動力はトルクコンバータ25,変速機27,ディファレンシャルギヤ29等を介して駆動輪をなす右後輪31,左後輪33に伝えられる。そして上記変速機27にはそのギヤ位置に対応したギヤ位置信号を出力するギヤ位置センサ27aが備えられており、また右後輪31,左後輪33及び従動輪のなす右前輪35,左前輪37にはそれぞれ車輪回転速度を検出するための車輪速度センサ31a,33a,35a,37aが設けられている。

舵角センサ39aはステアリング39の操作で変化する前輪35,37の舵角SAを検出する。舵角SAは第20図に示すごとく、車両の旋回中心CCを中心とし、右前輪35と左前輪37の中間点FCを通る円の、その中間点FC上の接線Ldと車両方向Mdとのなす角度で示される。

上述の各センサ及びアクセルペダル41の操作量に対応した信号を出力するアクセル操作量センサ41a,アクセルペダル41が解放されて、アクセル全閉となっている状態を検出するアクセル全閉センサ41b,ブレーキペダル43が踏み込まれたときにオンするブレーキセンサ43aの信号は電子制御ユニット（ECU）50に入力され、ECU50はこれらの信号に基づき上記ステップモータ9,噴射弁15,イグナイタ21を駆動するための信号を出力する。

上記ECU50は各種の演算を実行するCPU50a,CPU50aでの演算で必要なデータが一時的に格納されるRAM50b、同じくCPU50aでの演算で必要であり、エンジン作動中逐次更新され車両のキースイッチ51がオフされた後であっても記憶保持が必要なデータが格納されるRAM50c,CPU30aでの演算で用いられる定数等が予め格納されているROM50

ている。ここで、操舵角SAは直進状態で「０」、左旋回でマイナス、右旋回でプラスの値で表している。このようにすれば、旋回時に必要なサイドフォースを維持して安定した走行が確保される。

ここで目標スリップ率Ｓとドラッグ制御開始スリップ率Ｈとは、第19図に示すごとく、サイドフォースが十分なスリップ率に設定してある。従って、過大なエンジンブレーキにより車両走行が不安定となる前にドラッグ制御を開始させることが出来る。

次のステップ4380,4390では左右の駆動輪速度信号VRL,VRRからタイヤと路面の摩擦で生じる振動を取除くための処理を行なう。この振動は、周期30～50ms程度となることが多く、車両挙動を表す成分ではないため精度の高い制御を行なう場合取除かねばならない。本実施例では10～30Hzの領域のみ除く帯域除去フィルタを用いてノズル除去している。なお、発進加速時のみに対応する場合は10Hz以上の成分をすべて除く処理を行ってもよい。こうして得られた左右の駆動輪信号をそれぞれVRLF,VRRFとし最後にステップ4395で左駆動輪加速度GVRL,右駆動輪加速度GVRRをそれぞれVRLF,VRRFの前回値VRLFO,VRRFOとの差分に取って求め，車速信号処理を一旦終了する。

再び第４図に戻って、続くステップ4400では第８図にその詳細を示したスリップ状態判定処理にて、過大なスリップを生じた場合にフラグFTSをセットする処理が行われる。まずステップ4410で左後輪（駆動輪）33の速度VRLFとドラック目標駆動輪速度Vtとを比較し、VRLF＞Vtならばステップ4420へ進む。ステップ4420では左後輪保留速度XVRLと左後輪速度VRLFとを比較し、XVRL＝VRLFならばステップ4450でカウンタCRLの値を１増やす。XVRL≠VRLFならばステップ4430で左後輪保留速度XVRLに左後輪速度VRLFの値を設定してステップ4440でカウンタCRLの値を１とする。ステップ4440,4450の後はステップ4460で左駆動輪初期減速度GRLをクリアし、ステップ4520の右駆動輪処理に移る。このステップ4420～4460の処理は、左後輪速度VRLFが降下して目標駆動輪速度Vtを切った際の左後輪速度VRLFを左後輪保留速度XVRTとして保持する処理を実行している。勿論、十分短い間隔で本処理が繰り返されるのであれば、左後輪保留速度XVRLは目標駆動輪速度Vtに等しいのでわざわざ左後輪速度VRLFを保留せずに、目標駆動輪速度Vtそのものを用いても良い。後述するステップ4520においても同様である。

ステップ4410でVRLF≦Vtと判定されるとステップ4470へ進み、VRLFとドラッグ制御開始判定速度Vhとを比較し、VRLF＞Vhならばステップ4480でカウンタCRLの値を１増やしてからステップ4520へ進む。

VRLF≦Vhならばステップ4490で左駆動輪終端速度YVRLに左後輪速度VRLFの値を設定し、次のステップ4500ではXVRL,YVRL,CRLから左駆動輪初期減速度GRLを下式のごとく求める。

GRL＝（XVRL－YVRL）/CRL

次に、ドラッグ速度条件フラグFTSをセットしてステップ4520へ進む。

このステップ4490～4510の処理は、左後輪速度VRLFが更に降下してドラッグ制御開始判定速度Vhを切った際の左後輪速度VRLFを左駆動輪終端速度YVRLとして保持する処理を実行している。勿論、十分短い間隔で本処理が繰り返されるのであれば、左駆動輪終端速度YVRLはドラッグ制御開始判定速度Vhに等しいのでわざわざ左後輪速度VRLFを用いずに、ドラッグ制御開始判定速度Vhそのものを用いても良い。後述するステップ4520においても同様である。

続くステップ4520では左後輪33について行った上記処理（ステップ4410～4510）と同じ処理を右後輪31についても行い右後輪31のスリップ発生を判断すると共に、その判断時点での右後輪の減速度、すなわち右駆動輪初期減速度GRRを求める。最後にステップ4530で初期減速度GFIを左駆動輪初期減速度GRLと右駆動輪初期減速度GRRから求め、処理を一旦終了する。

第４図に戻り、信号入力ベース処理ステップ4000ではスリップ状態判定ステップ4400の次にはステップ4600でドラッグ制御の開始及び終了を判定する。その詳細を第９図に示す。まずステップ4610でスロットル弁７の駆動系等の異常の有無を判断する図示しない別処理にて異常有と判断されたときにセットされるフェイルフラグFFを見て、セットされていれば、異常時にドラッグ制御を実行することは適当ではないので、ステップ4660でドラッグ実行フラグFTをリセットして一旦終了する。

フェイルフラグFFがリセットされている場合に実行されるステップ4615では、ブレーキセンサ43aの信号BRKがオンならば、ドラッグ制御には不適当な運転状態であるので終了するためステップ4660へ進む。信号BRKがオフならばステップ4620にて、アクセル操作量AAをみて操作量判定値KA（本実施例ではKA＝1.5度）と比較する。AA≧KAならばエンジンブレーキが生ずるアクセル操作量AAではないので、ステップ4660へ進んで本処理を一旦終える。またAA＜KAならばステップ4630にてドラッグ実行フラグFTをみてドラッグ実行中か否かを判定する。

ドラッグ実行フラグFTがリセットされているとき、すなわち今までドラッグ制御が実行されていないときは、ステップ4640でドラッグ速度条件フラグFTSを見る。ここでドラッグ速度条件フラグFTSがセットされていれば、ドラッグ制御の条件が整ったことになり、ステップ4650でドラッグ実行フラグFTをセットし、ドラッグ速度条件フラグFTSがリセットされていればドラッグ実行フラグFTをセットせずにステップ4650を迂回して本処理を一旦終了する。

ステップ4630でドラッグ実行フラグFTが既にセットされていれば、ステップ4670にて、後述するスロットル制御ベース処理ステップ6000で繰り返し算出される目標スロットル開度THとドラッグ時目標開度THDRGとを比較

理を第13図に示す。

まずステップ6110においてエンジン回転速度Neに応じたトルクサチュレート開度Tsutとゼロトルク開度Tzeroとを第２表に例示したマップから補間して求める。

第２表

Ne	Tsut	Tzero
４００	７	０
８００	１３	０
１２００	１５	１
１６００	１７	１．５
２０００	２０	２
２４００	２２	３
２８００	２３	４．５
３２００	２４	６
３６００	２５	７
４０００	２６	８
４４００	２８	９
４８００	３３	１０．５
５２００	３８	１２
５６００	４０	１３
６０００	４３	１４

一般的にガソリンエンジンのスロットル開度とエンジントルクとの関係は第14図に示す通りで、スロットル開度零（全閉）からある開度（トルクサチュレート開度Tsut）まではトルクは直線的に増加し、更にそれより大きい開度（THMAX）でトルクは飽和し、それ以上いくら開度を大きくしてもトルクは増加しなくなる。また、回転速度Neを高くすると直線的な部分の傾きが小さくなり、トルクが飽和するスロットル開度は大きくなる。

従って後述するステップ6130では、上述のガソリンエンジンのスロットル開度とエンジントルクとの直線部分の関係に基づいて現在の駆動輪トルクTWを求めることになる。

このような次第であるから本実施例では予め実験によりエンジン回転速度Ne毎にゼロトルク開度Tzero及びトルクサチュレート開度Tsutを求めておき、その実験結果に応じて定まるエンジン回転速度Neとゼロトルク開度Tzero及びトルクサチュレート開度Tsutとの関係をマップとしてROM50d内に格納してある。そしてステップ6110では具体的にはエンジン回転速度Neに応じてトルクサチュレート開度Tsut及びゼロトルク開度Tzeroを上記マップより補間演算して求める。

次にステップ6120では現在のスロットル開度TAとトルクサチュレート開度Tsutとの関係を判断し、Tsut＞TAならばステップ6130にて、トルクサチュレート開度Tsutとゼロトルク開度Tzeroと現在のスロットル開度TAと最大スロットル開度におけるエンジントルク（飽和トルクMAXT）とを用いて現在の駆動輪トルクTWを下式のごとく前述の直線関係に従って算出し本処理を一旦終了する。

TW＝（TA－Tzero）・MAXT/（Tsut－Tzero）

またTsut≦TAならばステップ6140にて現在の駆動輪ト

本実施例のドラッグ制御に限れば、実行しなくてもよい処理である。特に第８図のスリップ状態判定処理を簡単化すると第21図に示すごとくとなる。即ち、両後輪速度VRLF及びVRRFが共にドラッグ制御開始速度Vhより大きければ（ステップ7010,7030）、エンジンブレーキによる過大なスリップは生じていないとして、何もなされないが、左後輪速度VRLF及び右後輪速度VRRFのいずれかがドラッグ制御開始速度Vh以下となれば（ステップ7010,7030）、ドラッグ速度条件フラグFTSをセット（ステップ7020,7040）して一旦終了することになる。以後の処理は上述したごとくとなる。

尚、駆動輪加速度GVRL,GVRRの下降程度、あるいは駆動輪減速度GRL,GRR,GFIの上昇程度から駆動輪速度VRLF,VRRFやスリップ状態を予測して、早期にドラッグ制御を実行するようにしてもよい。

上記実施例において、後輪31,33が駆動輪M1に該当し、エンジン１が動力発生手段M2に該当し、スロットル弁７が動力調節手段M3に該当し、舵角センサ39aが旋回状態検出手段に該当し、ECU50が負トルク検出手段M5、可変制御手段M6、制限手段M7及びスリップ状態検出手段M8に該当し、ECU50が実行する処理の内、ステップS4600が主に負トルク検出手段M5としての処理に該当し、ステップS6000のスロットル制御ベース処理が主に可変制御手段M6としての処理に該当し、ステップS6360,6370が主に制限手段M7としての処理に該当し、ステップS4400が主にスリップ状態検出手段M8としての処理に該当する。

尚、上記実施例ではエンジンの出力制御はスロットル弁によっていたが、スロットル弁によらず排気絞り弁にてエンジン１の背圧を調節して出力制御しても良い。この他に点火時期制御によりエンジン出力制御を実行してもよい。ディーゼルエンジンであれば燃料噴射量あるいは噴射時期を制御することによりエンジン出力制御を実行してもよい。

また内燃機関以外、例えば電気自動車等においては、供給電力量の制御にてドラッグ制御を実行でき、これも本発明の一実施態様である。

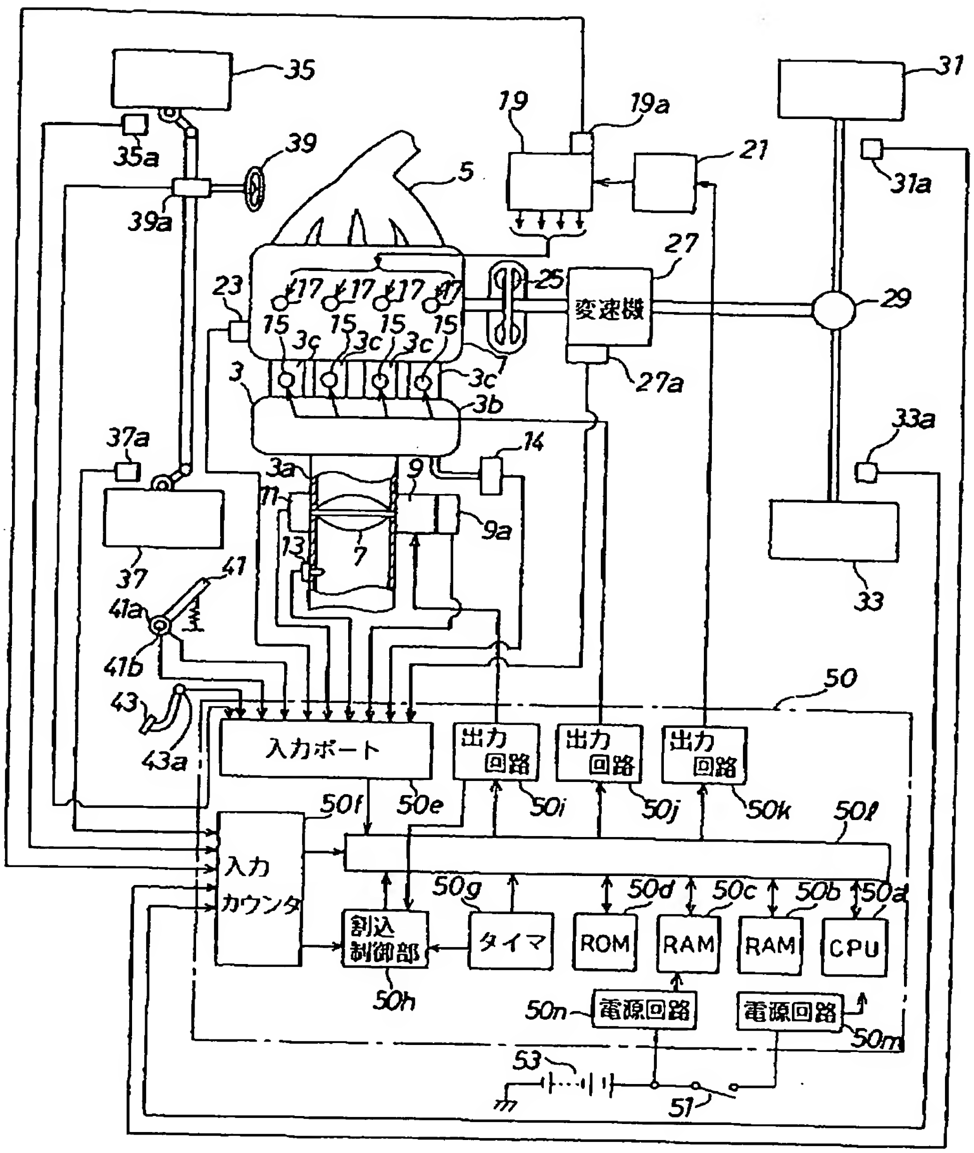
上記実施例では、負トルク検出手段M5として負のトルクが生じていることをアクセル操作量の程度から判定した（ステップ4620）が、スロットル弁７の開度が所定開度以下の場合に負のトルクが生じていると判定してもよく、この他にエンジン１の出力軸の捻れが、エンジンブレーキ時には通常の走行時に較べて逆になるので、その捻れの逆転から負トルク発生を検出し、ドラッグ制御開始の判断条件としてもよい。

【図面の簡単な説明】

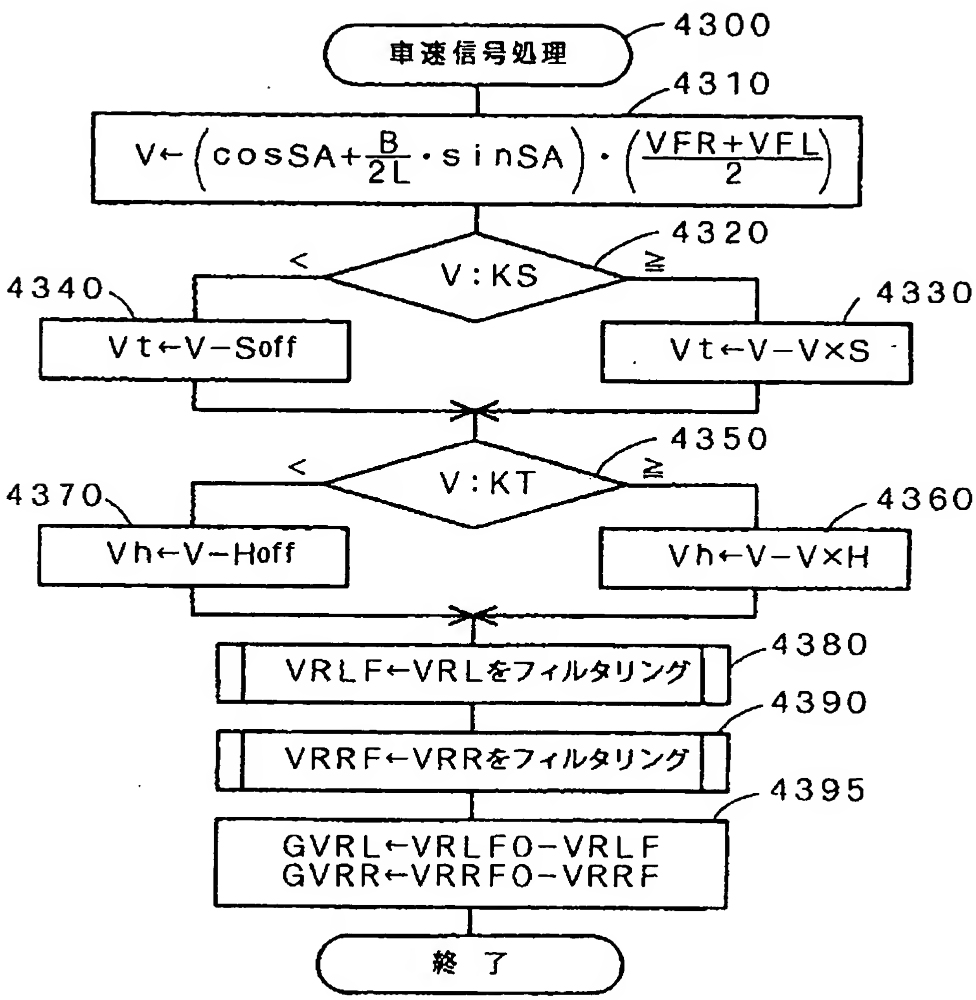
第１図は本発明の基本的構成例示図、第２図は本発明車両スリップ制御装置の一実施例をあらわす概略構成図、第３図はECUにて実行されるドラッグ制御全体の概略フローチャート、第４図はその信号入力ベース処理の詳細フローチャート、第５図は車速割り込み処理のフローチャート、第６図は車速信号処理の詳細フローチャート、第７図は車速Ｖに対するドラッグ目標駆動輪速度Vtとドラッグ制御開始速度Vhとの設定状態を示すグラフ、第８図はスリップ状態判定処理の詳細フローチャート、第９図はドラッグ制御の開始及び終了の判定処理の詳細フローチャート、第10図は燃料噴射ベース処理の詳細フローチャート、第11図はエンジン回転割り込み処理のフローチャート、第12図はスロットル制御ベース処理の詳細フローチャート、第13図は駆動輪トルクTW算出処理の詳細フローチャート、第14図はエンジン回転速度Neに応じたスロットル開度とエンジントルクとの関係を示すグラフ、第15図は目標駆動トルクFX算出処理の詳細フローチャート、第16図はドラッグ時目標開度THDRG算出処理の詳細フローチャート、第17図はモータ駆動割り込み処理の詳細フローチャート、第18図は操舵角SAと目標スリップ率Ｓ及びドラッグ制御開始スリップ率Ｈとの設定例を示すグラフ、第19図はスリップ率と制動力及びサイドフォースとの関係を示すグラフ、第20図は操舵角SAの説明図、第21図はスリップ状態判定処理の他の例のフローチャートである。

M1……駆動輪、M2……動力発生手段
M3……動力調節手段
M4……旋回状態検出手段
M5……負トルク検出手段
M6……可変制御手段、M7……制限手段、M8……スリップ状態検出手段、１……エンジン、７……スロットル弁、31,33……後輪（駆動輪）、39a……舵角センサ、50……ECU

【第２図】

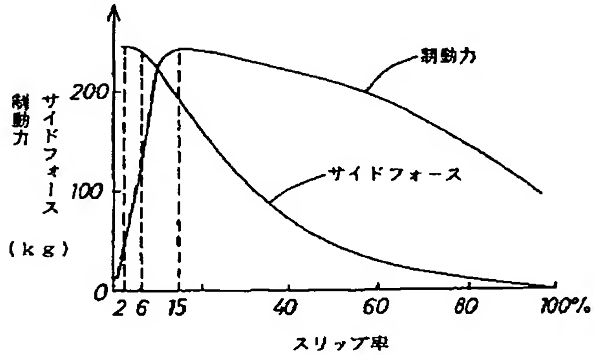

35
35a
39
39a
19
19a
21
5
31
31a
27
25
17
23
15
3c
3
3b
変速機
29
27a
37a
14
3a
9
11
9a
13
7
37
41
41a
41b
33a
33
43
43a
50
入力ポート
出力回路
出力回路
出力回路
50f
50e
50i
50j
50k
50l
入力カウンタ
50g
50d
50c
50b
50a
割込制御部
タイマ
ROM
RAM
RAM
CPU
50h
50n
電源回路
電源回路
50m
53
51

【第6図】

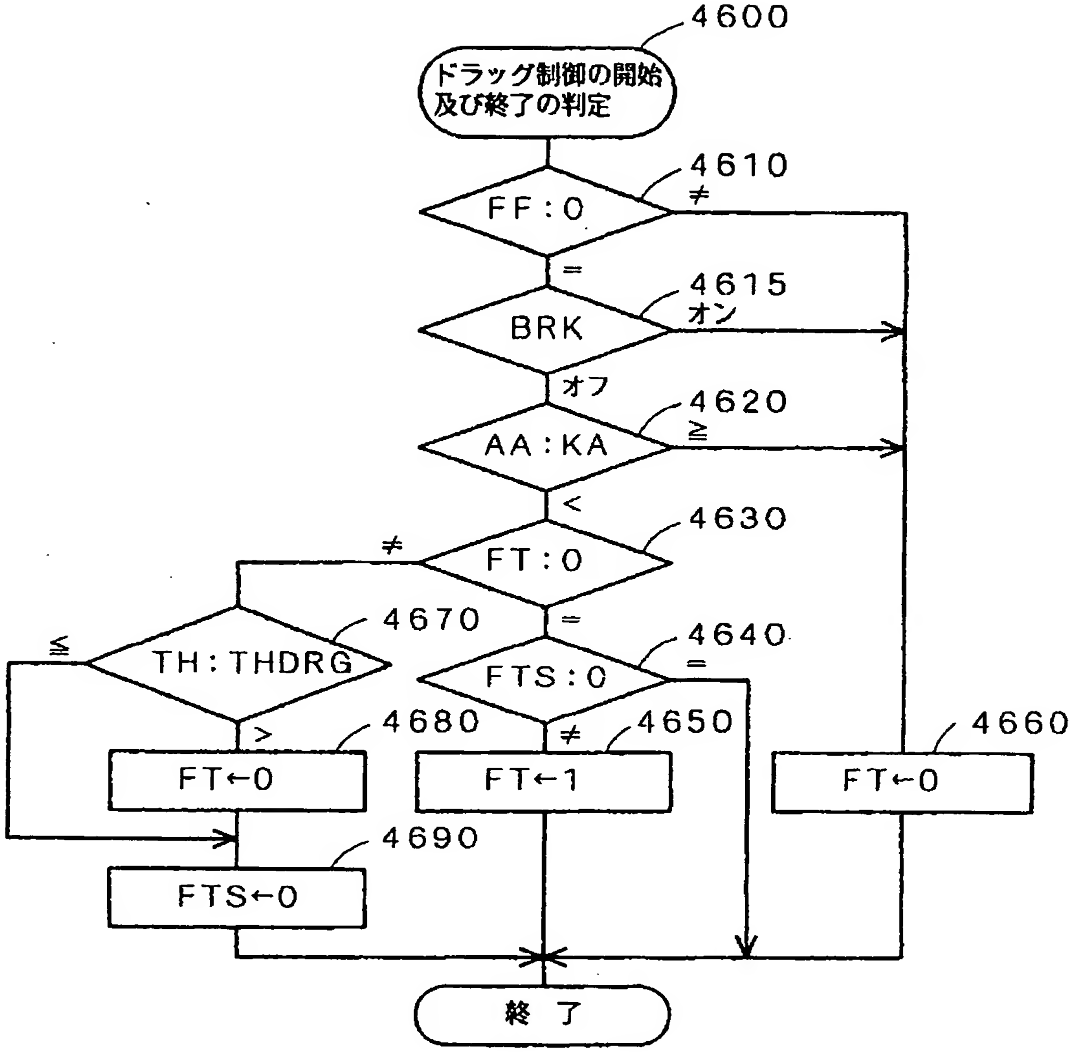


【第19図】

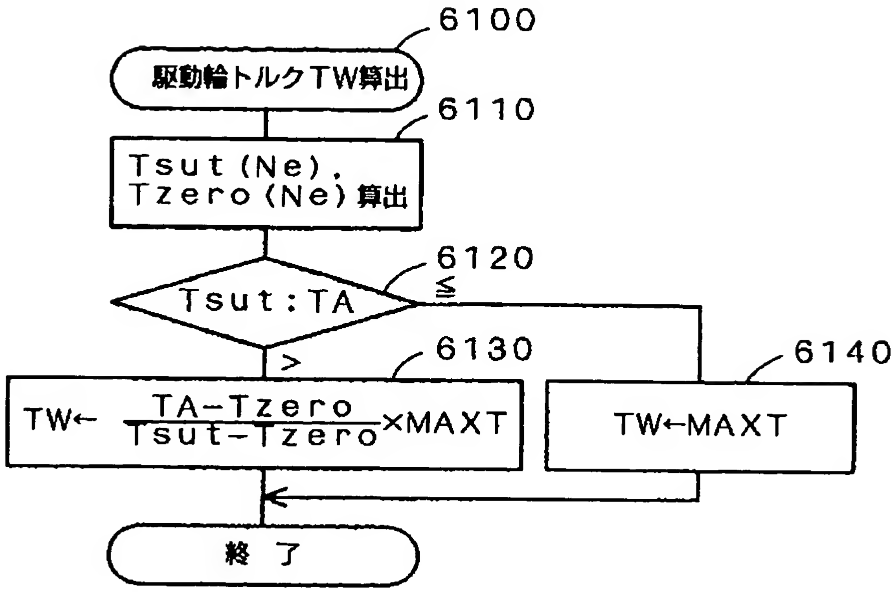
荷重：300kg



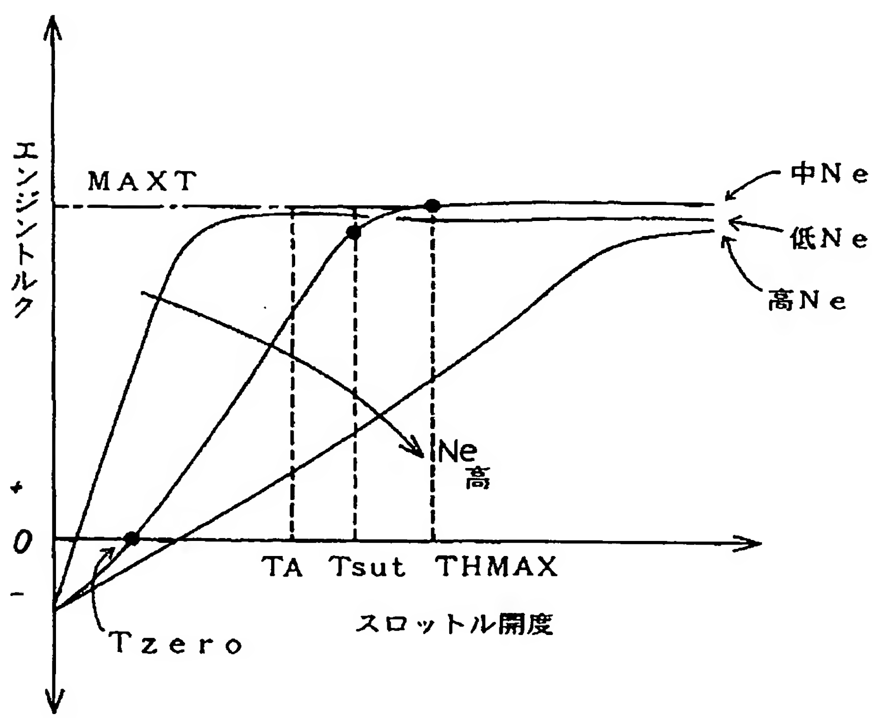
【第9図】


4600
ドラッグ制御の開始
及び終了の判定
4610
FF:0
≠
=
4615
BRK
オン
オフ
4620
AA:KA
≧
<
4630
FT:0
≠
=
4670
TH:THDRG
≦
>
4640
FTS:0
=
≠
4680
FT←0
4650
FT←1
4660
FT←0
4690
FTS←0
終 了

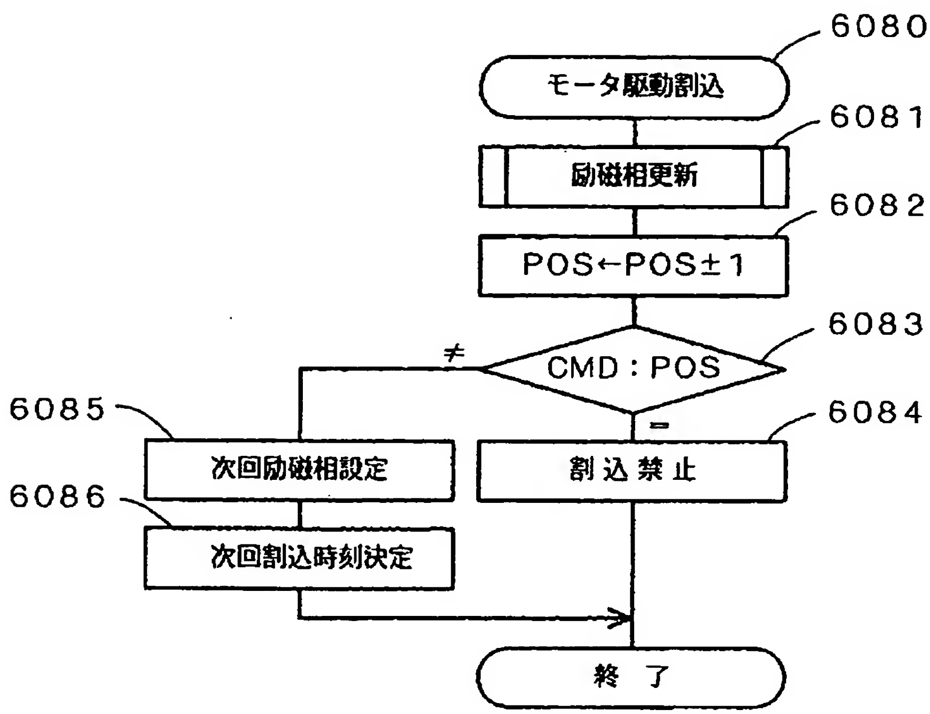
【第１３図】


6100
駆動輪トルクTW算出
6110
Tsut(Ne),
Tzero(Ne)算出
6120
Tsut:TA
≦
>
6130
TW← (TA−Tzero)/(Tsut−Tzero)×MAXT
6140
TW←MAXT
終　了

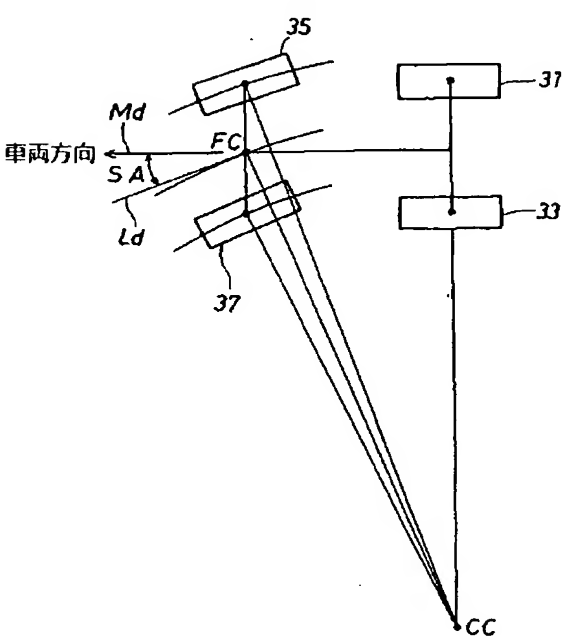
【第１４図】


エンジントルク
MAXT
中Ne
低Ne
高Ne
Ne
高
+
0
−
TA
Tsut
THMAX
スロットル開度
Tzero

【第17図】



【第20図】



【第21図】